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ABSTRACT

The objectives and the scope and sequence for the elementary school mathematics program of the Denver Public Schools (Colorado) are presented. The guide begins with a statement of the philosophy and general objectives of the K-12 mathematics program and a discussion of the methods of achieving those objectives. Several important ideas and concepts in the teaching of mathematics are described. A scope and sequence is presented which lists student objectives for each level from kindergarten through sixth grade under the following topics: (1) mathematical sentences; (2) number and numeration (whole numbers); (3) operations (whole numbers); (4) number and numeration (rational numbers); (5) operations (rational numbers); (6) geometry; (7) measurement; and (8) graphs, charts, and tables. Mathematics vocabulary words are listed with recommendations for introducing each word at either the primary or intermediate level. Following a statement of philosophy on teaching mathematics in kindergarten, an extensive grade-level outline is presented which further defines the objectives contained in the scope and sequence, this time combining the objectives for the various topics together for each grade level. The outline also relates each objective to activity resource guides which are listed as Denver Public Schools resources. The appendix provides descriptions and prices for these resource materials. (DC)

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THE MATHEMATICS PROGRAM OF THE

DENVER PUBLIC SCHOOLS

GRADES K-6

Prepared and Produced
in the
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Division of Education

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1981

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FOREWORD

Mathematics has always been an essential basic element of education. Furthermore, it has become apparent that today's children will require an increased awareness and knowledge of mathematical ideas and skills in order to become productive citizens of the future.

The program as outlined in this guide provides for a sound mathematical experience for all pupils. This experience incorporates those materials and techniques from the so-called modern mathematics programs that have been proven beneficial with those facets of traditional programs that have proven sound over the years. Modern concepts as well as the mastery of all computational skills will be stressed.

The mathematics program of the Denver Public Schools, through proper teaching and counseling, will produce high school graduates well prepared for college entrance, for placement in business and industry, or for the assumption of the role of a consumer in modern society.

Those teaching mathematics will find this guide beneficial to an improved mathematical experience for pupils in their classes.

Joseph E. Brzeinski
Superintendent

APPRECIATION

Appreciation is expressed to the following teachers, administrators, and parent who made a major contribution to this guide either by serving on the Elementary Mathematics Curriculum Committee or by writing on the guide:

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TABLE OF CONTENTS

	Page
Philosophy	1-6
Important Ideas in the Teaching of Mathematics Concepts	6
Sets	6-7
Number Sentences	7
Number	7-8
Number Systems	8-10
Geometry	10
Measurement	10-11
Topic Outline - Kindergarten through Sixth Grade	12
Mathematical Sentences	13-14
Number and Numeration (Whole Numbers)	14-15
Operations (Whole Numbers)	16-18
Number and Numeration (Rational Numbers)	18-19
Operations (Rational Numbers)	20-21
Geometry	21-23
Measurement	23-25
Graphs, Charts, and Tables	26
Vocabulary - Kindergarten through Sixth Grade	27-30
Kindergarten Statement	31
Grade Level Outline - Kindergarten through Sixth Grade	32
Kindergarten	33-38
Grade One	39-44
Grade Two	45-53
Grade Three	54-64
Grade Four	65-73

TABLE OF CONTENTS
(continued)

Page

Grade Five..... 74-81

Grade Six..... 82-88

Appendix..... 89-91

PHILOSOPHY OF THE K-12 MATHEMATICS PROGRAM

It is generally conceded that the need for one to think mathematically is becoming increasingly important. This is due to the complexity of living conditions brought about by sociological developments and to advances in scientific and technological knowledge. However, no computer or calculator can supersede the requirement of setting up quantitative situations for a solution or of estimating a reasonable solution for that situation.

Those responsible for teaching children at any level should have a general knowledge of the entire K-12 Mathematics Program. A study of the program will show that the foundation for reasoning and computation is laid carefully through many series of experiences at the beginning of the elementary school. This foundation is broadened and strengthened throughout succeeding grade levels. Facility with abstract quantitative thinking is ultimately attained by the continuous development of mathematical concepts and understandings.

The structure of mathematics and the nature of proof are emphasized.

Certain concepts in mathematics occur and recur, and these ideas are based on relatively few basic assumptions, axioms, postulates or properties. Emphasis should be placed on the assumptions which facilitate understanding and form the foundation for logical proof.

Conceptual learning should precede drill.

It is highly desirable that the development of a computational skill be preceded by a reasonable understanding of the concept involved. Concrete objects and other visual devices should be used to illustrate a new meaning or relationship. Gradually, less tangible materials can be used and, finally, symbols. A set of operations becomes related to a set of symbols through practice and experience. Practice and drill follow and will reinforce conceptual teaching.

Children's concepts evolve slowly.

Children's concepts evolve through experiences and usually require a spiral type of treatment--that is, reteaching on a broader basis at successive grade levels. Proper techniques of evaluation will reveal the concepts that require reteaching, those that require spaced review and drill, and those that require further development.

At any given grade level, pupils will possess varying degrees of maturity and ability. Each learner should be given the opportunity to attempt new topics of the program and advance to his maximum expectancy. He should be provided experiences in these topics commensurate with his ability through careful diagnosis of his needs in the elementary school and counseling in the secondary school. The degree of skill achieved will vary according to the ability of individual pupils.

A precise use of language is essential.

The development of a specialized vocabulary is important. The specialized

words, terms, and symbols of mathematics must be used precisely. Definitions must be stated carefully, consistent with the maturity of the pupil. Once a pupil has learned the correct terminology, it should be reinforced through use.

Objectives

Specifically, the purposes of the mathematics program are to enable every pupil to

1. refine his mathematical concepts, modes of thought, and problem-solving techniques (including checks)
2. know the decimal numeration system and know about other numeration systems
3. understand and perform with competence the four fundamental operations of mathematics
4. make reasonable estimations
5. acquire basic knowledge of commonly used statistics and the ability to interpret them
6. learn to read mathematical problems, explanations, and directions
7. gain the ability to use mechanical and electronic devices of a mathematical nature
8. understand and use common systems of measures and methods of graphing to compare quantities
9. understand and appreciate the part mathematics has played in the development of culture, the changes it is making in present-day living, and its potential for the future.

Application of Philosophy and Objectives

The achievement of goals depends largely on the use of methods by which meanings become clear and continuously refined. The K-12 program is based on the premise that the work at each level of instruction contributes to the pupil's total mathematical insight and achievement.

Learning is a continuous development through meaningful experiences closely related to the learner's needs. It involves relationships and understandings; it involves reorganization of previous learnings in order to solve increasingly difficult problems.

A meaningful experience results when children "discover" rules and make generalizations for themselves. This does not imply that children can make these discoveries without direction from the teacher. Teaching requires carefully planned and varied experiences designed to guide the pupil to state desired generalizations of mathematical concepts in his own words.

The important goals at all levels of maturity are that new insights be gained, that generalizations and understandings be discovered and applied, and that mathematical skills be perfected.

Mastery

Mastery is a demonstrated functional competence with a mathematical skill; it implies accuracy and understanding, but not necessarily speed. Some persons achieve mastery more easily than others, but performance varies at times in the same person. Therefore, it must be remembered that learning is a gradual process and that many pupils will not achieve mastery of the same skill at the same time. It is not necessary to keep studying one topic until complete mastery is achieved before going on to another topic.

It is reasonable to assume that all pupils can master some rudimentary concepts in each part of the mathematics program as it is presented. The degree of mastery will depend in part on the pupil's ability. In general, pre-testing and cumulative record data will indicate the type of learning experience he should be given and the achievement he should attain.

Individual differences

Individual differences exist among pupils in all classes at all levels of instruction. The teacher should recognize these differences and use all possible means to provide instruction commensurate with the abilities of the pupils.

One means of helping each pupil raise his level of achievement is through grouping for instruction. This is particularly true in primary grades. Groups should be flexible in nature, and a regrouping may be desirable after a period of instruction. A pupil should not be prevented from moving ahead at a reasonable pace in his grade level just because he cannot compute accurately.

At the beginning of every school year, the teacher should use the following sources of information to determine the skill-level of each pupil.

Cumulative records
Standardized tests of achievement
Informal teacher-made tests
Diagnostic tests and inventories
Teacher judgment and observation

In order to provide for an individual or for a group of pupils whose arithmetic achievement is extremely high or low, the teacher may need to give consideration to acceleration, to enrichment, or to modification of the regular program. For purposes of this program the terms are defined as follows:

Acceleration--extending the learning experiences at any grade level into the content of the next higher grade.

Enrichment--extending the work of the present grade level by adding new and varied experiences which may not be experienced at later grade levels.

Modification--presenting to the less able pupils most phases of the arithmetic program at their level of understanding and ability to perform computation.

Textbooks and other printed materials

Because current textbooks are designed to present mathematical concepts in a stimulating, concrete, and meaningful way, there need be no conflict between the K-12 program and the textbooks. The textbooks recommended for use will present the material outlined in the guide, though the sequence of presentation in each textbook may vary. A teacher following the sequence of a textbook will have taught the material outlined in this guide.

Each textbook has a teacher's edition which should be used fully in daily planning and teaching. A teacher's edition contains helpful information such as background material, objectives for the lesson, procedures to follow, and suggestions for providing for individual differences as well as answers and solutions to selected examples.

The following plan is recommended for the use of textbooks and other printed materials in teaching new concepts:

- Consult the teacher's edition of the textbook for suggestions for teaching the concept.
- Select work from the textbook that is appropriate to the concept.
- Develop the suggested concept by having pupils work with concrete objects and other visual devices, when possible, until the meaning is clear.
- Express the concept in written form, using paper, the chalkboard, or both, with the class actively participating.
- Use appropriate practice material to insure understanding of the concept.

Teaching aids and calculators

Concrete objects and other visual devices are important in the development of mathematical concepts. These instructional devices are needed to bridge the gap between the intuitive and the formal mathematical aspects of a situation. A teacher should become familiar with the devices in the school that will aid in teaching. It should be borne in mind that whether the aids used are concrete or representational, they are used primarily as a preparation for abstract thinking and symbolic expression.

The use of calculators in the classroom is encouraged. Calculators help students to better learn mathematics and solve contemporary problems. They also support the development and discovery of mathematical concepts. The effective use of calculators can improve student attitudes toward, and increase interest in, mathematics. They need not detract from the memorization of computational facts.

Drill and maintenance

Drill is essential in a mathematics program. Emphasis on concept teaching does not remove the necessity of drill, although it may decrease it. The two important aspects of drill are (1) that it be presented only after the concept has been developed and (2) that it be varied. Drill may be oral, written, or both. It may take the form of a puzzle, game, or number sentence. It may involve perception cards, flash cards, or other devices. A short drill period each day is desirable for recall and retention.

Any activity that enables a pupil to use the mathematical concepts and processes he understands may be regarded as a maintenance activity. There are innumerable situations that should be utilized in the total, integrated school program and which involve concepts, facts, and skills learned in the arithmetic program. The teacher should also use well-planned and frequent reviews that bring learned skills and facts into new uses.

Homework

Homework shall be assigned in the amount and with the frequency determined by pupil needs. These needs occur when

- the curriculum requires more time than is available in the school day to meet proper standards of achievement.
- absence necessitates homework.
- a pupil is not working up to his ability.
- a particular difficulty is to be overcome.
- progress within a group is to be maintained.
- a pupil is to be encouraged to broaden his understandings.
- specific skills are to be developed.

Whatever the objective of homework, the maturity of the pupil should be considered.

It is important that pupils, parents, and teachers understand the objectives of homework. Therefore, all means of communication within the school, between the home and school, and among the grade levels, K-12, should be utilized. Homework assignments should be made only after they have been carefully explained and developed with children.

Since valuable instruction time is lost by having children copy assignments to be worked at home, textbooks, workbooks, and other printed materials may be sent home as part of the assignment.

Evaluation

The effectiveness of the K-12 Mathematics Program can be measured in terms of the pupil's ability to reason and to compute according to his expectancy and grade level.

Evaluation is made by using one or more of several techniques--testing, observation, and consultation.

Pretesting determines a pupil's preparedness for new work. Periodic testing enables the teacher to discover the degree of achievement made by the pupil in relation to his ability and to his peers. Diagnostic tests reveal individual and group weaknesses and indicate needs for reteaching and mastery. Standardized survey tests provide a means of comparing the skills and understandings of a pupil with national norms.

Evaluation by observation is often more revealing than test results. It gives the teacher a mental picture of the pupil at work in a day-by-day classroom situation and helps the teacher discover the reasons for strengths or weaknesses revealed by a test.

Consulting with a pupil as he works is likely the most useful evaluation the

teacher can make. The pupil's responses reveal his manner of thinking, his attitudes, and work habits. These help the teacher discover the maturity level at which he is working so that provision may be made for reteaching or enrichment as the case requires.

IMPORTANT IDEAS IN THE TEACHING OF MATHEMATICS CONCEPTS

Foreword

The elementary school mathematics curriculum experienced some rather radical changes when "modern mathematics" was introduced in the late 1950's. A new formalism, symbolism, vocabulary, and rigor along with a few new topics altered much of the methodology but did not materially affect traditional grade placement and progression of computational skills.

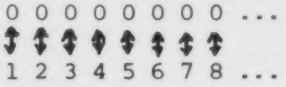
Evaluation of "modern mathematics" in the 1970's has resulted in modification of many of the instituted changes. Most of the ideas and principles have been retained, but much of the symbolism and formality has been deemphasized in the newer textbooks. It behooves a teacher of elementary school mathematics to be knowledgeable about the big ideas and principles and to use the symbolism and formalism in keeping with the student's ability to comprehend.

The following topics and paragraphs enumerate and explain some of these ideas and principles behind today's mathematics curriculum.

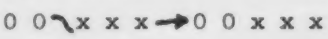
Sets

The concept of sets provides a unifying agent in mathematics, permeating all areas as well as interrelating topics.

Many basic ideas of sets (collections or groups as they are often called) may be introduced in the primary grades. A set may be described as a collection of objects, for example, the set of pupils in the classroom, the set of chairs in the lunchroom or the set of books on the shelf. Any member of a set is called an element. Consider a baseball team. The pitcher is an element of the set as is the catcher. The umpire is not an element of the set. When the elements of a set are counted, the result is called the cardinal number of the set. Children in the primary grades should learn rational counting by putting each member of the set in one-to-one correspondence with a counting number.



The combining of elements of two or more sets (union of the sets) may be analogous to the addition of numbers under most conditions. A group of 2 objects combined with a group of 3 objects results in a larger group containing 5 objects.



As opposed to combining sets, sets are often separated into subsets. When a

subset of 2 is removed from a set of 5, a subset of 3 remains. This concept is analogous to subtraction when dealing with cardinal numbers.

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In later grades students rely heavily on sets of numbers. For instance, one may list the set of multiples of 2 as 2, 4, 6, 8 ... and the set of multiples of 3 as 3, 6, 9, 12 .... The least common multiple of the two sets could be the common denominator for adding halves and thirds. Quite often numbers are divided into sets of factors. As an example, 24 contains the set of factors 1, 2, 3, 4, 6, 8, 12, 24, while 16 contains the set of factors 1, 2, 4, 8, 16. The common factors (the intersection of the two sets) is the set 1, 2, 4, 8. The greatest common factor of these (8) will reduce the fraction 16/24 to the lowest terms.

Number Sentences

The algebraic equation and inequality are introduced as number sentences in the elementary grades. The sentences (often called equation forms) are the vehicles for mathematical statements and the expression of mathematical ideas.

In primary grades children should learn that number sentences may express either true ideas, $3 + 4 = 7$, or false ideas, $3 - 4 = 8$. It is important that a judgment be made upon each statement for truthfulness. Number sentences may also be closed sentences or open sentences. A closed sentence, such as $3 + 4 = 7$, can be judged to be true or false as it appears, while an open sentence, such as $\square + 3 = 7$, cannot. An open sentence makes use of a placeholder to stand for one element in the sentence. A value must be substituted for the placeholder before it can be judged to be true or false.

Replacement set and solution set are two terms associated with the solution of sentences. The replacement set is that set of numbers from which values are selected for substitution for the placeholder. The solution set is that set of numbers from the replacement set that make the number sentence true.

Number sentences can express an equality ($\square + 4 = 7$) or an inequality ($\square + 5 > 7$). The solution set of an equality generally contains one member while the solution set of the inequality will contain many members. The solution for $\square + 5 > 7$ would be all numbers greater than 2. It is important in solving the inequality to define the replacement set carefully.

In the intermediate grades, the graphing of number sentences on the number line can be easily taught as well as the graphing of sentences with two placeholders.

Number

It is important in early school years to develop concepts relating to numbers carefully. For example, the quality of threeness is the same whether applied to three boys or three apples. The quality of a number should be emphasized as separate from the articles it enumerates, just as blueness is a quality separate from the objects which have this quality in common. The quality of threeness is also described by the cardinal number three, and this number is applied to any collection having the "three" quality.

In the primary grades teachers are always alert to the need of pupils to develop a sense of order relationships, such as is found in the sequence of counting numbers. Thus, 7 is more than 6 or 5, and 7 is less than 8 or 9. When order relationships are determined for cardinal numbers, they then may be called ordinal numbers.

The order relationship for the sequence of counting numbers leads to a logical interpretation of place value. This is one of the facets of arithmetic that must receive emphasis in the elementary school. There are many devices useful for teaching place value, namely, the abacus, pocket charts, hundred board, and various counters. An analysis of a numeral such as 333 leads to an understanding of the value of each of the 3's because of the position it occupies.

One special order relationship, used extensively later, that may be introduced at this time is that of ordered pairs (the location of points on a grid). An ordered pair can be briefly described as follows: (x, y) is an ordered pair where, because of the position of each, x always stands for the first considered item and y for the second. Pupils in the primary grades are usually weighed and measured. The teacher may use this opportunity to note height first and weight second. Thus the ordered pair (49, 60) would stand for a height of 49 inches and a weight of 60 pounds, since this is the order agreed upon.

In the intermediate grades the concept of order relationships is extended to include fractions, both common and decimal. For example, many pupils do not recognize the order relationship between such numbers as 0.00080 and 0.0030 and are often incorrectly inclined to choose the former as the greater. An understanding of place value and significant digits would help the student recognize the correct order.

The concept of ordered pairs can be extended at these grades through consideration of ratios and graphs. The ratio fraction is another example of an ordered pair. In plotting and interpreting graphs, pupils should be encouraged to set up an ordered pair relationship in reading the horizontal (abscissa) and vertical (ordinate) values on the graph. The accepted practice in mathematics is to read first the value on the horizontal scale and, second, the value on the vertical scale.

The foundation for the teaching of signed numbers can be laid at this time by identifying numbers 'below zero' or 'less than zero' with the negative sign in front of such numerals, for example, temperatures below zero and negative scores in games.

It is important that the notation for a negative number be different from that of the symbol for subtraction; thus, -16 is interpreted as the operation of subtracting 16 from whatever precedes it; whereas, $^{-}16$ is interpreted as a negative 16 and $-(^{-}16)$ implies subtracting a negative 16 from what precedes it.

Number Systems

Almost all of the computations of elementary school mathematics are performed within the rational number system. This system evolves through a gradual number system expansion as the needs for solutions to problems arise.

The development of the rational number system begins with the set of counting numbers ($\{1,2,3,4,5,\ldots\}$), two operations (plus [+] and times [x]), and an equals relation (=). This set has the property that the result of either of the operations on any two numbers is itself one of the numbers in the set. This is called the closure property.

Problems such as $3 + 2 = \square$, $3 \times 5 = \square$, and $3 + \square = 5$ may be solved in this set of numbers. To make $3 \times \square = 3$ a true statement, the number 1 must be the replacement for the $\square$. This number, 1, is called the multiplicative identity and has the special property that any number times 1 equals that number. However, to make $3 + \square = 3$ a true statement, the number 0 must be added to the counting numbers. The resulting set of numbers is called the whole numbers. Zero is called the additive identity and has the special property that when added to any number it gives that number.

As students progress the need to solve the statement $3 + \square = 2$ will arise. To result in a true statement (closure maintained), $\square$ must equal $^{-}1$. Thus the set of whole numbers must be expanded to include the set of negative numbers, $\{\ldots{}^{-}3, {}^{-}2, {}^{-}1\}$. The set of negative numbers, zero, and the set of counting numbers are termed the set of integers.

Yet, there is no solution within the set of integers for the sentence $3 \times \square = 1$. Hence the fractions (representations for expressing the ratio of two integers) must be introduced. With the positive, negative, and rational numbers and zero, most of elementary school arithmetic is accomplished (only problems such as $\square \times \square = 2$ are excluded).

The development of the rational number system is a logical consequence of fundamental laws which guide the operations performed on these numbers. It is important that students understand these laws. Early in the grades instruction depends heavily on (1) the commutative law which states that the order of adding or multiplying two quantities does not affect the sum or product and (2) the associative law which states that the grouping of addends or factors does not affect the sum or product. Thus $3 + 2 = 2 + 3$ and $2 \times 3 = 3 \times 2$. Similarly $2 + (3 + 5) = (2 + 3) + 5$ and $2 \times (3 \times 5) = (2 \times 3) \times 5$.

As subtraction and division are introduced into the curriculum, a reexamination of these laws must be made. It soon is apparent that $8 - 6 \neq 6 - 8$ and that $4 \div 2 \neq 2 \div 4$. Likewise $3 - (2 - 1) \neq (3 - 2) - 1$ and $6 \div (3 \div 2) \neq (6 \div 3) \div 2$. Hence the operations of subtraction and division are neither commutative nor associative.

At this point the relationship between addition and multiplication may be examined. When multiplying a two place number by a one place number such as 24×6, the operation can be performed as $(20 + 4) \times 6$. The distributive law of multiplication over addition allows us to restate $(20 + 4) \times 6$ as $(20 \times 6) + (4 \times 6)$. Thus, if a, bc and c are rational numbers, then $a \times (b + c) = (a \times b) + (a \times c)$.

As the study of fractions is undertaken, the inverse elements should be developed. Students already know that $a + 0 = a$ and that $a \times 1 = a$. The inverses are those numbers which, when combined with any element in the set, produce the identities. $2 \div ({}^{-}2) = 0$; so $^{-}2$ is the inverse of 2. And $3 \times 1/3 = 1$; so 1/3 is the inverse of 3. Restated, if a is any rational number, $a + ({}^{-}a) = 0$, and ^{-}a is the additive inverse of a; and $a \times 1/a = 1$ $(a \neq 0)$, and 1/a is the multiplicative inverse. The latter, often called the reciprocal, is important in the study of division of fractions.

At each step in the development system, the number line may be used to place numbers in their proper order as well as to demonstrate the operations on these numbers.

Geometry

Arithmetic and geometry in the mathematics curriculum are complementary subjects and not isolated topics. At every opportunity these two topics should be related. The number line provides one source of relating number and points on a line. The introduction of the array when studying multiplication gives a geometric illustration of an arithmetical operation. Ordered pairs relate naturally to the Cartesian plane, which may be intuitively visualized as two crossed number lines.

In the primary grades, standard geometric forms and shapes are introduced, and some attention is given to their properties. This attention is in general terms with such expressions as "square corners" or "same length." Some non-metric concepts about the properties of plane figures are begun through an introduction of point, line, plane, and space. Points are visualized as an exact location in space represented by a dot; a path of points determines a line. Some lines are "straight" and are represented by a line drawn along a ruler. Parts of lines are called line segments and are what children will deal with mostly. Lines are infinitely long; line segments have end points. A ray is different from a line segment in that it has one end point and extends infinitely in one direction.

In later grades a plane is developed to enhance the more formal study of plane figures. A plane is a set of points represented by a flat surface that extends infinitely in all directions. Planes may be represented in the classroom by the desk top or the floor. A set of points that begins and ends at the same point without crossing itself is a closed curve. Polygons are special closed curves. Two rays with a common end point form an angle. The study of polygons, then, may proceed from the concepts of closed figure, line segment, and angle.

Congruence is an important concept in geometry. It is necessary to develop the difference in meaning between "equality" and "congruence." Equality implies logical identity, while congruence indicates same size, measure, or shape. Therefore, two lines cannot really be equal but rather are congruent. Congruence also applies to angles and figures. Basic geometric construction using the ruler, compass, and protractor should be explored and applied to construction of basic geometric figures.

The concept of area measurement will be developed in the same vein as linear measurement, that is from an arbitrary measure to a standard measure. A concept that needs to be explored is that of "region." Triangle refers to the closed curve, and triangular region refers to the union of the triangle and the points inside the curve. Areas of regions are found, not areas of triangles. Further, since area is a two-dimensional measure, area is a number and not a region as sometimes intimated.

Measurement

Measurement is the process that ties together mathematics and the physical

world. Because measurement involves numbers, it is an integral part of the entire K-12 Mathematics Program.

The process of measurement assigns a number to a quantitative situation concerned with some magnitude. For example, situations that require answers for questions of how big? -how heavy? -how high? -how long? require measures.

A development of measurement concepts should begin with the arbitrary unit. The measure of a quantity is the number of times the arbitrary unit can be fitted along or into the quantity to be measured. The value of standard measures becomes apparent from this approach.

It is essential that any and all study of measurement now include the metric system as well as the customary units. Students will need to be conversant with both during the transition to the metric system. It is important that students be given approximate relationships for comparison between the two systems. Examples might be these: a liter is a little larger than a quart; a centimeter is about the width of a fingernail; a kilogram is about 2 1/5 pounds. It is also important that the students make no direct conversions between the two systems. Students are not to be given exercises converting meters to inches by multiplying by 39.37 or quarts to liters by dividing by 1.06.

When teaching the metric system, emphasize the advantages these measures offer. First, it is a decimal base system; second, the prefixes denote the multiples of the base; and third, it is consistent with measurement systems of other nations.

In the primary grades the types of quantities to be measured are introduced: that is, time, distance, weight, capacity, and length. These are followed by the common units that measure: namely, the hour, minute, mile, pound, meter, kilogram, etc.

In later grades a more formal study of measurement systems is conducted. Other measures such as area and volume are explored. Square and cubic measure follow the same development as linear measure, i.e., from an arbitrary unit to a standard unit. Throughout all grades the approximation of measures is stressed. An example of such notation might be "The measure of line segment AB is approximately 6". Attention is given to finer divisions on the measuring instrument in order to increase the precision of the measurement.

Computation with measures should have actual situations as a basis. Drill on conversion of units should be avoided.

TOPIC OUTLINE

Kindergarten Through Sixth Grade

The topic outline contains the total scope and sequence for the K-6 Mathematics Program. This section presents an overview of the program with the concepts to be taught arranged by topic. THOSE MARKED WITH AN ASTERISK ARE THE MINIMAL OBJECTIVES FOR THE GRADE LEVEL. The development of specific concepts and the continuity of the program can thus be traced by the teacher.

The teacher will find the mathematics program organized by grade level on pages 33 through 88.

Kindergarten

- No direct instruction in kindergarten.

Grade one

- Understanding of the equality symbol.
- Naming a number with a number sentence.
* Determining true or false number sentences.
* Computing the missing addend or subtrahend; facts 0-10.
- Supplying the operational symbol.
* Using equality and inequality symbols.

Grade two

* Solving for missing addend or subtrahend; facts 0-18.
- Solving for missing minuend.
* Supplying inequality symbol to compare numbers.
- Using inequality symbols in comparing sums and differences.
- Completing sentences with more than one solution.
- Solving sentences where the sum or difference comes before the equality sign.

Grade three

* Solving problems using placeholders, addition and subtraction, no regrouping.
- Solving problems using placeholders, addition and subtraction, regrouping.
- Finding the missing factors.
- Solving sentences where the sum, difference, or product comes before the equality sign.
- Solving open sentences involving inequalities.
- Using inequality symbols in comparing sums, differences, products.

Grade four

- Writing number sentences to include fractions.
- Supplying missing numbers, placeholder in any position.
- Substituting letters for placeholders.

Grade five

- Extending mathematical sentences to include decimal numbers.
- Writing number sentences to solve word problems.

Mathematical Sentences (cont.)

Grade six

- Writing number sentences for all operations involving equalities and inequalities.
- Using sentences to solve ratios and percentage problems, and to find perimeter, area and volume.
- Writing number sentences to solve word problems.
- Using integers in number sentences.

Number and Numeration (Whole Numbers)

Kindergarten

* Distinguishing between members and nonmembers of sets.
* Identifying comparative sizes of sets.
* Identifying equivalent sets.
**Naming cardinal numbers of sets of up to ten elements.
* Writing the cardinal of a set of up to ten elements.
* Identifying zero (empty set).
* Ordering number cards with numerals 1-5.
* Describing position, ordinal numbers first through third.
- Completing patterns.
* Identifying relative positions of objects.
* Counting to 20.

Grade one

- Understanding one-to-one correspondence.
* Counting by ones to 100.
* Counting to 20 by twos, to 50 by fives.
* Identifying even, odd numbers to 10.
* Completing sequences, one- and two-digit numbers.
- Numbering before or after a given number.
* Using ordinal numbers through tenth.
* Evaluating numbers in terms of tens and ones.
* Comparing numbers, greater or lesser.
- Recognizing number words through 10.

Grade two

* Writing numerals to 200.
* Counting by twos, fives, tens, to 100.
- Numbering before or after a given number.
- Supplying missing numbers in sequences, one-, two-, and three-digit numbers.
* Distinguishing between odd and even numbers to 20.
- Counting by twos, odd numbers.
- Devising other counting patterns.
* Using ordinal numbers through twentieth.
- Recognizing number words through 20.
* Demonstrating place value through the hundreds.
* Evaluating numbers in terms of hundreds, tens, ones.
- Identifying the place value of a number in a standard numeral.
- Experimenting with four-digit numbers.

Number and Numeration (Whole Numbers) (cont.)

Grade three

* Reading, writing numerals through the thousands.
- Reading, writing numerals less than 1,000,000.
- Identifying million's place.
* Writing four-digit numerals in expanded notation.
- Stating value of each digit in six-digit numerals.
* Writing numerals for numbers, 10 or 100 more than a given number.
- Supplying missing numbers in a sequence through four-digit numbers.
- Ordering numbers by ones, twos, fives, tens, hundreds, or thousands.
- Using ordinal numbers through thirtieth.
- Identifying three-digit numbers as odd or even.
* Mastering Roman numerals through 10.
- Rounding to the nearest 100.

Grade four

* Sequencing numbers forwards, backwards with a range from 0 to 999,999.
- Reading, writing numbers through millions.
* Identifying place value, face value for digits in five-digit numerals.
- Extending place value, millions.
* Writing five-digit numerals in expanded notation.
* Writing Roman numerals to 50.
- Supplying relational symbols between equations.
- Rounding off numbers to the nearest 1,000.
- Understanding greatest common divisor and properties of 1 and 0.
- Understanding zero as a factor.
- Identifying numbers as odd or even, through six-digits.

Grade five

- Finding common multiples of two numbers.
- Finding the least common multiple of two numbers.
- Reading and writing numbers through billions.
* Identifying place value for digits in six-digit numerals.
- Understanding expanded notation.
- Using exponents in expanded notation and cubic measurement.
* Determining if a number is divisible by 2, 5, or 10.
* Understanding prime and composite numbers.
* Writing Roman numerals through 100.
* Rounding whole numbers to the nearest 10, 100, and 1,000.

Grade six

* Translating a number word description into a standard numeral through millions.
- Understanding expanded and scientific notation.
* Identifying prime and composite numbers.
* Factoring a composite number into prime numbers using exponents.
- Finding the greatest common factor of two numbers.
- Finding the lowest common multiple of two numbers.
- Determining if a number is divisible by 2, 3, 5, 9, or 10.

Kindergarten

* Sequencing logically a series of events.
* Classifying objects by attributes.
* Combining sets.
* Separating sets.
* Counting answers to simple addition and subtraction situations.
- Making up number stories from pictures.
- Identifying how many more or less when comparing sets.

Grade one

- Combining and separating sets.
* Solving basic facts, sums and minuends through 10, oral and written.
- Solving basic facts, sums and minuends exceeding 10.
* Understanding the empty set, addition and subtraction with 0.
* Demonstrating commutative property for addition.
* Writing and solving a problem for an illustration.
* Demonstrating the associative principle, with an illustration given.
* Adding three numbers, sums not exceeding 10.
- Adding four numbers, column form.
* Adding and subtracting two-digit numbers, no regrouping.
- Exploring inverse relations, addition and subtraction.

Grade two

* Mastering addition and subtraction facts, sums and minuends through 18, vertical and horizontal forms.
* Understanding commutative property, addition.
* Understanding associative principle of addition.
- Writing related sentences, addition and subtraction, basic facts.
* Adding three or more numbers, vertical and horizontal form.
* Adding numbers, sums three-digits or less, no regrouping.
- Adding numbers, sums three-digits or less, with regrouping.
* Subtracting from three-digit numbers, no regrouping.
- Subtracting numbers, regrouping from the ten's to the one's place.
* Writing equations for word problems.
* Skip-counting to solve problems, introduction to multiplication.
- Understanding multiplication as repeated addition.
- Experimenting with multiplication problems, factors 5 or less.

Grade three

* Mastering 100 basic addition and subtraction facts.
* Writing related addition and subtraction sentences for three given numbers.
* Solving addition problems with regrouping in ten's and hundred's places.
* Solving subtraction problems with regrouping in the ten's and one's places.

Operations (Whole Numbers) (cont.)

Grade three (cont.)

- Understanding when or when not to regroup, addition and subtraction.
- Adding numbers larger than three digits.
- Subtracting numbers involving renaming with zeros.
* Showing multiplication as repeated addition.
* Mastering multiplication facts through 5.
* Showing division as repeated subtraction.
- Multiplying and dividing facts 6 through 9.
* Understanding commutative principle for multiplication.
- Understanding associative principle for multiplication and addition.
- Writing multiplication and division sentences for arrays.
* Identifying inverse relationships between multiplication and division.
- Completing related multiplication and division sentences, basic facts.
- Multiplying three numbers, basic facts.
- Multiplying 10 or 100 by numbers less than 100.
- Multiplying multiples of 10 or 100 by numbers less than 10.
* Multiplying three-digit factors by one-digit factors, regrouping twice.
* Solving even division problems, three-digit dividends and divisors 2 through 5.
- Solving even and uneven division problems, two-stage.
- Estimating answers.
* Solving addition and subtraction word problems, writing the equation.
- Writing and solving word problems for all operations.

Grade four

* Solving three-addend addition problems, regrouping to the thousand's place.
* Solving four-digit subtraction problems, regrouping from the thousand's place.
- Adding and subtracting six-digit numerals, with or without regrouping.
- Supplying missing numbers in solving equalities, with or without regrouping.
* Mastering 100 multiplication facts, oral and written.
* Solving multiplication problems, two-digit multiplicands, two-digit multipliers, regrouping.
- Solving problems with ratios and equal ratios.
- Solving problems involving multiples of 10.
- Solving multiplication problems, four-digit multiplicands by one-digit multipliers and three-digit multiplicands by two-digit multipliers, regrouping.
* Solving even and uneven division problems, three-digit dividends and one-digit divisors.
- Solving even and uneven division problems, four-digit dividends by one-digit divisors and three-digit dividends by two-digit divisors.
* Computing with zeros, any four-digit numeral, four basic operations.
- Recognizing commutative and associative laws and special properties of 1 and 0 for simplifying problem solving.
- Solving equations with parentheses.
- Calculating averages.
- Estimating in all four operations.
- Solving word problems by separating out pertinent facts from given information.
- Solving one- and two-step word problems, four basic operations.

Operations (Whole Numbers) (cont.)

Grade five

* Adding whole numbers, addends not exceeding five digits.
* Subtracting whole numbers, subtrahend and minuend not exceeding five digits.
* Giving products for randomly selected multiplication facts, oral and written.
* Multiplying using one-, two-, three-digit multipliers.
* Demonstrating multiplication as both commutative and associative.
* Writing number sentences to illustrate the identity element and the zero property in multiplication.
* Giving the quotients for randomly selected division facts, oral and written.
* Dividing, one- and two-digit divisors and four-digit dividends, all difficulties.
- Checking addition, subtraction, multiplication, division problems.
- Solving one-, two-, and three-step word problems.

Grade six

* Adding whole numbers, all regrouping difficulties.
* Subtracting whole numbers, all regrouping difficulties.
* Multiplying four-digit multiplicands and up to three-digit multipliers.
* Dividing with two-digit divisors and five-digit dividends.
- Working problems when numbers are given in equation form, four basic processes.
- Adding and subtracting negative integers.
- Using estimating in problem-solving and checking.
* Demonstrating the distributive property in multiplication.
* Solving word problems involving two or more steps.

Number and Numeration (Rational Numbers)

Kindergarten

- Recognizing equal parts of an object.

Grade one

* Identifying halves, thirds, and fourths.
- Identifying fractions naming one part of a whole.

Grade two

* Identifying fractions naming parts of wholes: one-half, one-third, one-fourth, one whole.
- Identifying fractions where the numerator will show more than one.

Number and Numeration (Rational Numbers)

Grade two (cont.)

- Identifying fractional parts of sets.
- Comparing fractional parts with inequality symbols.
- Reading, writing fractional numbers.

Grade three

* Identifying fractional parts, halves through eighths.
- Understanding order of fractions.
- Writing a fraction for a shaded part of a region or for part of a set.
- Identifying equivalent parts and writing fractions equal to 1.
- Comparing fractions, like or different denominators, model given.
- Writing mixed numbers.
- Understanding that 1/3, 1/4, 1/5 illustrate dividing by 3, 4, and 5.

Grade four

- Understanding the terms numerator and denominator.
* Identifying mixed numbers on a number line.
* Using the correct relational symbol between fractions.
- Writing equivalent fractions.
- Writing decimal fractions to the hundredth's place.
- Understanding the decimal point as locating the one's place.
- Writing a decimal fraction for a mixed number.
- Understanding decimal qualities as related to the U.S. monetary system.

Grade five

* Giving place value for each digit in a decimal numeral, not to exceed hundredths, oral and written.
* Explaining fractions (common and decimal) on a number line.
- Ordering fractional numbers, smallest to largest, largest to smallest.
- Ordering decimal numbers, smallest to largest, largest to smallest.
- Rounding decimals to the nearest whole number.

Grade six

* Extending decimal place value through the millionths.
- Extending understanding of relationship among fractions, decimals and percentages.
* Arranging a set of fractional numbers, largest to smallest, smallest to largest.
- Arranging a set of decimal numbers, largest to smallest, smallest to largest.
* Converting fractions, decimals, percentages and ratios to equivalents.
* Rounding of decimal fractions to the nearest tenth and hundredth.

Operations (Rational Numbers)

- No direct instruction in Grades K-3

Grade four

- Writing a fractional part of a number.
* Computing the sum of two like fractions.
* Computing the difference for two like fractions, no regrouping.
- Adding and subtracting mixed numerals having like denominators.
- Adding and subtracting unlike fractions, common denominator present.
- Renaming mixed numbers as improper fractions and vice versa.
- Finding the greatest common divisor.
- Adding and subtracting decimal fractions to the hundredth's place, with renaming.

Grade five

- Determining if fractional numbers are expressed in simplest forms.
* Writing the correct mixed numeral for an improper fraction and vice versa.
- Finding equivalent fractions; checking.
* Computing sums of two fractions or mixed numbers with common denominators, answers in lowest terms.
* Computing differences of two fractions or mixed numbers with common denominators, regrouping difficulties, answer in lowest terms.
- Computing sums and differences of unlike fractions and mixed numbers, common denominator present, answer in lowest terms.
- Computing sums and differences of unlike fractions and mixed numbers, common denominator not present.
- Computing sums and differences of mixed numbers, renaming.
* Computing products of any two fractions.
- Writing equivalent ratios.
- Renaming remainder in division as a fraction in lowest terms.
* Computing sums and differences for decimal numerals, two decimal places.
- Multiplying decimals including annexing zeros to the product.
- Dividing decimals, decimal in dividend only.
- Determining reciprocal of fractions or whole numbers.
- Estimating with decimals.
- Comparing and ordering decimals from largest to smallest and vice versa.
- Solving word problems using fractions and decimals.

Grade six

* Computing the sums of fractions and mixed numerals, all difficulties.
* Computing the differences of fractions and mixed numerals, all difficulties.
* Computing the product of two fractions or mixed numerals.
- Determining if a fractional number is in simplest form.
* Writing correct mixed numeral for an improper fraction, and vice versa.
* Computing the quotient of two fractional or mixed numbers.
* Computing sums of decimals, extending to thousandths.
* Computing differences of decimals, extending to thousandths.

Operations (Rational Numbers) (cont.)

Grade six (cont.)

* Computing the product for decimal numerals, product containing up to four decimal places.
* Dividing decimals with decimal in divisor and dividend, demonstrating use of the caret.
- Introducing percentages, solving all cases of percentage problems.
- Understanding ratio as a useful problem-solving method.
- Using fractions, decimals, and percentages in problem-solving.
- Finding missing numbers in equal ratios.
- Using estimation with fractions and decimals.

Geometry

Kindergarten

* Identifying circles, squares, rectangles and triangles.
- Identifying the shortest path between two points.
- Identifying open and closed paths.
- Identifying interior and exterior of closed paths.

Grade one

* Identifying circles, squares, rectangles, and triangles.
- Identifying similarly shaped objects.

Grade two

- Drawing lines and line segments with a straight edge or ruler.
* Identifying shapes: circle, square, rectangle, triangle; differentiating between open and closed curves.
- Constructing geometric shapes between given points.
- Identifying whether a point or object is inside, outside, or on a simple closed curve.
- Identifying, counting sides and corners.
- Beginning understanding of properties of plane figures.
- Demonstrating the concept of congruence.
- Identifying unilateral symmetry.

Grade three

* Identifying and drawing simple closed plane curves.
- Identifying points inside, outside or on simple closed curves.
- Identifying angles and right angles.
- Counting the number of sides and corners in a geometric figure.
- Finding congruent figures.
- Drawing line segments and congruent line segments.

Geometry (cont.)

Grade three (cont.)

- Drawing diagonals.
- Identifying a cube.

Grade four

- Understanding points as exact locations in space; understanding space as the set of infinite points.
* Understanding the terms point, line, line segment and ray.
* Classifying quadrilaterals as squares, rectangles, or parallelograms.
- Identifying parallel and intersecting lines.
- Defining the terms angles, right angles and vertex.
- Identifying triangles, pentagons, and hexagons.
- Using a straight edge and compass for measuring and drawing line segments.
- Understanding congruency.
- Identifying center, radius, and diameter of a circle.
- Identifying horizontal and vertical lines.
- Identifying rectangular prisms, cylinders, cones, spheres, cubes, and pyramids.
- Identifying and drawing lines of symmetry.
- Finding perimeters of polygons.
- Finding perimeters and areas of squares and rectangles.

Grade five

* Understanding concepts of space, line segments, lines, rays, angles, sides, planes, faces, and vertices.
* Understanding concepts of intersecting, parallel, and perpendicular lines.
- Understanding congruency for angles, line segments, and figures.
- Understanding concept of symmetry.
* Defining a circle using the terms center, radius, circumference, and diameter.
- Understanding uses of a protractor in measuring and drawing angles.
- Understanding use of compass in constructing circles and congruent angles and in bisecting line segments and angles.
- Identifying simple closed curves (paths).
- Identifying geometric figures: polygons, pyramids, cylinders, cones, spheres.
* Computing area and perimeter of rectangles and squares.
- Computing volume of rectangular solids.
- Computing circumference of circles.
- Locating points on a grid, given numbered pairs.
- Naming numbered pairs for points on a grid.

Grade six

- Reviewing concept of points, space, planes, lines, line segments, rays, angles, parallel lines, perpendicular lines, intersecting lines, faces and vertices.

Geometry (cont.)

Grade six (cont.)

- Reviewing congruency of angles, line segments, and figures.
- Reviewing and extending concept of symmetry.
- Reviewing the descriptive terms for a circle; knowing a circle has 360°.
- Identifying closed curves (paths).
- Knowing names and definitions of geometric figures: polygons, pyramids, cylinders, cones, spheres.
- Using a protractor for measuring and drawing angles.
- Using a compass in constructing circles and in bisecting a line segment and an angle.
- Finding the degrees of a third angle in a triangle when the degrees of two angles are known.
* Using formulas to find perimeters and areas of triangles, squares, circles, and rectangles.
- Using formulas to find volume of rectangular solids and cylinders.
* Naming numbered pairs for points on a grid; locating points on a grid, given numbered pairs.

Measurement

Kindergarten

* Demonstrating understanding of comparative height, distance, weight and size terms.
* Ordering objects according to size.
* Comparing containers in terms of volume.
* Identifying coins: penny, nickel, dime.
- Evaluating a collection of pennies.
* Naming days of the week in order.
- Observing clock hour hand.
- Measuring objects by comparing them with a non-standard instrument.

Grade one

- Measuring length using non-standard units.
* Measuring length in inches and centimeters.
* Telling time; hour and half-hour.
- Reading time; standard notation, hour and half-hour.
* Identifying representations of weeks, months, days on a calendar.
* Comparing relative weights (masses) of objects.
- Measuring capacity: pints and quarts.
- Identifying values: penny, nickel, dime.
* Counting 25¢ with pennies, nickels, dimes.
- Making change from dimes and nickels with pennies.

Grade two

* Naming days of the week, months, seasons.

Grade two (cont.)

* Reading and interpreting a calendar.
* Telling and writing time to the quarter hour.
* Measuring length using inches and centimeters.
- Recognizing instruments for measuring feet, yards, meters.
- Measuring to the half-inch.
* Measuring capacity: cup, pint, quart.
- Using half-pint, half-gallon, gallon for measuring capacity.
- Selecting appropriate capacity measures.
* Understanding measures of weight (mass): pounds and kilograms.
- Recognizing symbols: ¢, $.
- Telling values of coins.
- Counting collections of coins.
* Making change for 5¢, 10¢, 25¢, 50¢.
- Identifying dozen and half-dozen.
- Selecting proper measuring instruments.

Grade three

* Reading a clock to the nearest 5 minutes.
- Computing time on a clock.
- Understanding the concept of a.m. and p.m.
- Describing length or width using a non-standard unit of measurement.
* Measuring yards, feet, inches, half-inches, meters, and centimeters.
- Choosing an appropriate customary or metric unit of length for a given measurement.
- Find perimeter in centimeters and customary measurements.
- Finding area by counting square units (centimeters).
- Finding volume by counting cubic units.
* Differentiating among gallons, quarts, pints, cups, half-gallons, and liters.
* Differentiating among pounds, half-pounds, quarter-pounds, ounces, grams, and kilograms.
- Giving equivalent measures for length, weight, and capacity.
* Making change for units to $1.
- Counting and recording sums of money using the dollar sign and cents point.
* Adding and subtracting money values to $5.
- Telling temperature using the Fahrenheit and Celsius systems; identifying freezing and boiling points.
- Extending understanding of a calendar to include the holidays.

Grade four

* Telling time in seconds, minutes, hours, days, and years.
- Understanding the term century.
- Using a.m. and p.m.
- Using addition and subtraction algorithms in computing time.
* Making change to $10.
* Adding, subtracting, and multiplying money values to $10.
- Computing with money to include division and values over ten dollars.

Measurement (cont.)

Grade four (cont.)

* Finding equivalent measures for ounces, pounds, and tons.
* Finding equivalent measures for cups, pints, quarts, and gallons.
* Measuring distances in inches, feet, yards, and miles.
- Extending measurement to one-eighth inch.
* Finding perimeters using metric or customary measurements.
* Measuring distances in meters and centimeters.
- Finding length to the nearest millimeter.
- Finding area in metric and customary measurements.
* Measuring volume and mass in liters, kiloliters, grams, and kilograms.
- Finding volume of a rectangular prism in metric and customary measurements.
- Choosing an appropriate metric unit of length or weight (mass).
- Finding equivalent measures (i.e., 16 oz. = 1#).
- Determining temperature on a Celsius and a Fahrenheit thermometer.
- Solving word problems involving measurement.

Grade five

- Understanding the approximate nature of measurement.
- Knowing and understanding U.S. Customary System of measurement.
* Knowing and understanding the metric-system prefixes, deka- and hecta-.
- Making conversions among customary units.
- Making conversions among metric units.
- Computing perimeter, area, and volume of quadrilaterals in customary units and metric units.
- Computing circle measurements using $C = \pi d$.
* Computing averages for a group of like measurements.
- Computing time, rate, and distance.
- Working with protractor in developing concepts of angle and degrees.
- Working with decimals and fractions in computing measurement.
- Knowing and understanding measurement of time.
- Knowing and understanding the U.S. Monetary System.
- Estimating time and length.

Grade six

- Understanding the approximate nature of measurement.
- Knowing and understanding U.S. Customary System of measurement.
- Knowing and understanding the metric system.
- Making conversions among customary units and metric units.
* Adding and subtracting using metric and customary measurement.
- Computing perimeter, area, and volume in customary and metric measurement.
- Solving word problems involving measurement.
- Understanding measurement of time.
- Understanding U.S. Monetary System.
- Using estimation when working with measurement.

Graphs, Charts, and Tables

Kindergarten

* Locating objects in relation to right and left.
- Completing simple graphs.

Grade one

* Distinguishing between left and right, top and bottom.
- Reading, interpreting, completing simple bar graphs.

Grade two

- Reading, interpreting simple bar graphs.
- Constructing bar graphs, gathering data from environment.

Grade three

- Interpreting, reading, and constructing simple tables, bar graphs, pictographs, and schedules.
- Finding sums and differences for graphs, charts, and tables.
- Locating points on a grid.

Grade four

- Interpreting, reading, and constructing simple bar and picture graphs.
- Locating points on a coordinate plane.
- Interpreting, reading, and constructing line graphs.
- Completing function tables and charts, all processes.
- Interpreting and reading a time schedule.

Grade five

- Interpreting tables, schedules, graphs, and coordinate grids.
- Constructing bar, line and circle graphs and coordinate grids.
- Understanding scale drawings.
- Understanding use of legends.
- Solving problems using tables, schedules and graphs.

Grade six

* Interpreting charts, graphs, and coordinate grids.
- Constructing bar, line, and circle graphs and coordinate grids.
- Understanding and drawing scale drawings.

The development of a specialized vocabulary is important. Specialized words, terms, and symbols of mathematics must be used precisely. It is hoped the following vocabulary lists will help in this regard.

POSITIONAL TERMS

K - 2 = P
3 - 6 = I

p	1.	above	p	26.	largest
p	2.	after	p	27.	last
p	3.	ago	p	28.	left
p	4.	alike	p	29.	less than
p	5.	all	p	30.	longer
p	6.	altogether	p	31.	longest
p	7.	as many as	p	32.	matching
p	8.	back	p	33.	middle
p	9.	before	p	34.	more
p	10.	belongs	p	35.	more than
p	11.	below	p	36.	most
p	12.	beside	p	37.	next
p	13.	between	p	38.	on top of
p	14.	bottom	p	39.	one less
p	15.	comparing	p	40.	one more
p	16.	fewer	p	41.	out
p	17.	greater than	p	42.	patterns
p	18.	high	p	43.	right
p	19.	higher	p	44.	round
p	20.	how many	p	45.	short
p	21.	in	p	46.	shorter
p	22.	in front of	p	47.	shortest
p	23.	inside	p	48.	some
p	24.	into	p	49.	thickness
p	25.	larger	p	50.	top
			p	51.	under

VOCABULARY WHOLE NUMBERS

p	1.	addend	p	21.	even number
p	2.	addition	I	22.	expanded notation
I	3.	approximation	I	23.	exponent
I	4.	array	I	24.	factor
I	5.	associative property	I	25.	factor tree
I	6.	average	I	26.	greatest common factor
p	7.	basic fact	p	27.	grouping
p	8.	column form	I	28.	inequality
I	9.	common factor	I	29.	integers
I	10.	common multiple	I	30.	inverse
I	11.	composite number	I	31.	least common multiple
p	12.	difference	I	32.	minuend
p	13.	digit	p	33.	multiplication
I	14.	distributive property	p	34.	multiplying
p	15.	divide	I	35.	negative
I	16.	dividend	p	36.	number
I	17.	divisible	p	37.	numeral
I	18.	divisor	p	38.	odd number
I	19.	equation	p	39.	opposite
I	20.	estimation	I	40.	order

VOCABULARY WHOLE NUMBERS (cont.)

K - 2 = P
3 - 6 = I

p	41.	ordinal number	p	52.	renaming
I	42.	period	I	53.	Roman numeral
p	43.	place value	I	54.	rounding rounded number
I	44.	positive	I	55.	simplest
I	45.	power	p	56.	skip counting
I	46.	prime	p	57.	solve
I	47.	probability	I	58.	square number
I	48.	product	p	59.	standard numeral
I	49.	quotient	p	60.	subtraction
p	50.	regrouping	p	61.	subtrahend
p	51.	remainder	p	62.	sum
			p	63.	zero

VOCABULARY RATIONAL NUMBERS

I	1.	common denominator	I	11.	millionths
I	2.	cross product	I	12.	mixed number
I	3.	decimal	I	13.	numerator
I	4.	denominator	I	14.	percent
p	5.	equal	I	15.	probability
I	6.	equivalent	I	16.	ratio
p	7.	fraction	I	17.	reciprocal
I	8.	hundredths	I	18.	reduce
I	9.	inequality	I	19.	tenths
I	10.	lowest terms	I	20.	thousandths

VOCABULARY GEOMETRY

I	1.	acute	p	21.	edge
I	2.	angle	I	22.	endpoint
I	3.	area	I	23.	equilateral
I	4.	base	I	24.	face
I	5.	bisect	I	25.	flat surface
p	6.	center	p	26.	graph
p	7.	circle	I	27.	grid
I	8.	circumference	I	28.	hexagon
p	9.	closed path (curve)	I	29.	horizontal
I	10.	compass	I	30.	intersect
I	11.	cone	I	31.	isosceles
I	12.	congruent	p	32.	length
p	13.	corner	p	33.	line
I	14.	corresponding parts	p	34.	line of symmetry
I	15.	cube	I	35.	number pair
I	16.	curved surface	I	36.	obtuse
I	17.	cylinder	I	37.	octagon
I	18.	degree	I	38.	ordered pair
I	19.	diagonal	I	39.	parallel
I	20.	diameter	I	40.	parallel lines

I	1.	parallelogram
I	2.	perpendicular
I	3.	perimeter
I	4.	pi
p	5.	point
I	6.	polygon
I	7.	prism
I	8.	protractor
I	9.	pyramid
I	10.	quadrilateral
I	11.	radius
I	12.	ray
p	13.	rectangle
I	14.	rhombus
I	15.	right
I	16.	scalene
I	17.	segment
p	18.	shape
p	19.	side
I	20.	similar
I	21.	sphere
p	22.	square
p	23.	straight edge
p	24.	symmetric
I	25.	trapezoid
p	26.	triangle
I	27.	vertex
I	28.	vertical
I	29.	vertices
I	30.	volume
I	31.	width

MEASUREMENT

TIME

P	1.	a.m.
I	2.	annual
I	3.	bi- (prefix)
p	4.	calendar
I	5.	century
p	6.	clock
p	7.	day
I	8.	decade
p	9.	digital
p	10.	hour
I	11.	leap year
p	12.	minute
p	13.	month
I	14.	p.m.
p	15.	second
I	16.	semi- (prefix)
I	17.	standard
p	18.	today
p	19.	tomorrow
p	20.	yesterday
I	21.	zones
		Eastern
		Central
		Mountain
		Pacific

TEMPERATURE

I	1.	below
I	2.	boiling point
I	3.	Celsius
I	4.	degree
I	5.	Fahrenheit
I	6.	freezing point
I	7.	Kelvin
p	8.	thermometer
p	9.	zero

MONETARY

I	1.	bill
p	2.	cent sign
p	3.	change
p	4.	coins
p	5.	cost
I	6.	decimal point
p	7.	dime
I	8.	discount
p	9.	dollar sign
I	10.	estimation
p	11.	half
p	12.	money
p	13.	nickel
p	14.	penny
p	15.	price
p	16.	quarter
p	17.	selling price

MEASUREMENT MISCELLANEOUS

K - 2 = P
3 - 6 = I

P	1.	amount
I	2.	approximate
I	3.	capacity
I	4.	cubic
I	5.	depth
I	6.	distance
P	7.	dozen
I	8.	estimate
I	9.	fluid
P	10.	half
I	11.	height
P	12.	length
I	13.	linear
P	14.	liquid
I	15.	mass
P	16.	measure
P	17.	meter stick
P	18.	pair
P	19.	quarter
I	20.	rate
P	21.	ruler
P	22.	square
P	23.	third
P	24.	weight
I	25.	width
I	26.	volume
P	27.	yard stick

MEASUREMENT

U. S. CUSTOMARY SYSTEM

P	inch (I sq. in., cu. in.)
P	foot, feet
I	yard
I	mile
I	acre
I	teaspoon
I	tablespoon
P	cup
I	half-pint
P	pint
P	quart
I	half-gallon
I	gallon
I	ounce
P	pound
I	ton

METRIC

I	millimeter square millimeter mm^2 cubic millimeter mm^3
P	centimeter
I	decimeter
I	meter
I	dekameter
I	mectometer
I	kilometer
I	milligram
I	gram
P	kilogram
I	milliliter
I	liter
I	kiloliter

GRAPHS, CHARTS, AND TABLES

P	1.	bar graph
I	2.	circle graph
I	3.	coordinate grid
I	4.	grid
P	5.	line
I	6.	legend
I	7.	pictograph
P	8.	points
I	9.	schedule
I	10.	symbol
I	11.	table

KINDERGARTEN

The kindergarten teacher uses materials and equipment in the natural environment to build mathematical concepts. The teacher develops these concepts informally through the familiar ongoing kindergarten activities. Mathematics programs in kindergarten can be effectively implemented with little written work by children.

Mathematical experiences are most successful when they are interesting and motivational, provide for success, and allow for individual differences among pupils. It is therefore necessary to integrate mathematical knowledge with a knowledge of child development and learning.

The child's first experiences in mathematics must be planned to prepare him for the sequence of concepts that he will encounter at future levels of maturity. Number experiences need to be brief to correspond with the attention span of his maturity level.

Listening to stories, hearing the rhythm and repetition in music and in nursery rhymes, exploring the functions of the clock and calendar, experiencing simple measurement concepts as needed in classroom activities, encountering the beginning concepts of the four operations--all these are some of the first steps in building mathematical knowledge.

Written work is to be kept to a minimum. Activities that involve writing should be limited to prepared sheets on which children mark an X on a specified numeral, circle a group of objects, or draw lines between matching items. Later in the year, children may begin number formation and do follow-the-number pictures.

Grade Level Outline
Kindergarten through Sixth Grade

The following section contains the mathematics program outlined by grade level for kindergarten through grade six. The grade level programs are divided into the topics which are taught.

Listed under each topic are the appropriate concepts to be developed. Those marked with an asterisk are the minimal objectives for each grade level. All children should be given extensive experience with these concepts and 65% or more of the children should attain mastery[1] for each concept. Many children will have the ability to achieve beyond the minimal objectives. It will be expected that children will explore[2] most of the other concepts listed for that grade level, with mastery of these depending upon the ability and experience of the individual child.

For suggestions on introducing and teaching each concept see the teacher's edition of the mathematics textbook.

The textbooks which are recommended for this program will present the material outlined in this guide. Although the sequence of presentation in a text may vary from the guide, a teacher following the sequence of that textbook will have taught the material contained in the program.

The Denver Public Schools has several other publications available for teachers to use in supplementing their mathematics programs. Referenced alongside each concept are suggested activities from Stretch 1-3, Stretch 4-6, and Action Math. (See the appendix for descriptions of these materials and other publications for use in supplementing the CORE program.) The activities denoted may be used as presented, may be modified, or may be expanded to fit individual needs.

Footnotes:

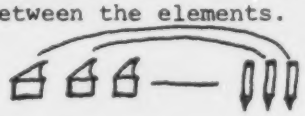
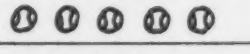
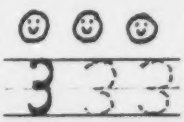
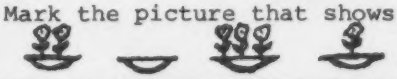
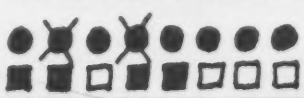
Definition of terms as used in this outline:

[1] The use of the term mastery implies competence with a mathematical skill. Accuracy and understanding are vital parts of the mastery of a particular skill. Remember that it is not necessary to keep studying a topic until complete mastery is achieved before going on to another topic.

[2] To explore or exploration implies the introduction of a new concept or set of facts, not mastery of the concept or facts but rather awareness of their existence. Mastery of explored topics comes at a later time.

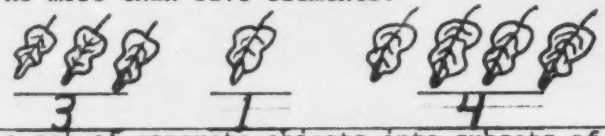
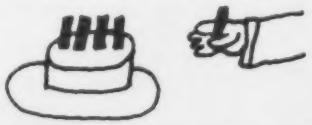
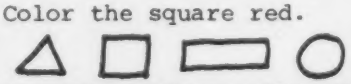
K I N D E R G A R T E N

GRADE K

OBJECTIVE	REFERENCES AND RESOURCES
Number and Numeration	
* 1. Distinguish between members and nonmembers of a set when given the classification food, toys, animals, people and clothes.	*AM 1,2
* 2. Given two sets of objects, identify characteristics of the sets using the terms more, less, greater than and less than.	AM 7,8,9
* 3. Demonstrate that two sets having not more than five elements each are equivalent using one-to-one correspondence between the elements. Example: 	AM 3
* 4. Name the cardinal number of a set of not more than ten members. Example: Mark the number that tells how many.  4,5,6	AM 4,5,6,11,12, 13,14,30
* 5. Write the numeral that names the cardinal number of a set of not more than ten members. Example: Write the numeral. 	AM 28,29,31
* 6. Identify the empty set (concept of zero). Example: Mark the picture that shows zero. 	AM 15
* 7. Order a set of number cards with the numerals 1-5 listed.	AM 154,156
* 8. Identify the order of three objects by their ordinal names first, second, third.	AM 213
9. Complete a given number pattern. Example: 	
* 10. Given an object in a picture, identify the position of the object in terms of below, above, over, under, behind, in front of and beside.	
* 11. Count to 20.	

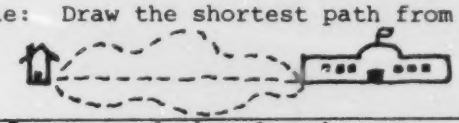
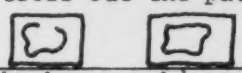
* Action Math

GRADE K

OBJECTIVE	REFERENCES AND RESOURCES
Operations	
* 1. Put in logical sequence a series of three events depicted in story pictures.	
* 2. Classify objects according to properties, i.e., color, size, shape, weight, texture, etc.	AM 1,2
* 3. Combine two sets of concrete objects into a set that contains no more than five elements. Example: 	AM 65,66
* 4. Separate a set of concrete objects into subsets of from one to five elements. Example:	AM 83
* 5. Given a picture story, circle the numeral that tells how many in all or how many left. Example:  4, 5, 6	
6. Make up a number story from a picture.	
7. Identify or discriminate between two sets which contain 1 more, 2 more, 1 less or 2 less objects.	AM 10
Rational Numbers	
1. Recognize an object divided in equal parts. Example: Which picture shows three equal parts? 	AM 265
Geometry	
* 1. Select or name a circle, square, rectangle, or triangle from a set of objects or a picture. Example: Color the square red. 	AM 215

*Action Math

GRADE K

OBJECTIVE	REFERENCES AND RESOURCES
Geometry, (continued)	
2. Name the geometric shape (circle, square, rectangle or triangle) when given a description of its attributes.	AM 219
3. Identify the shortest path between two points. Example: Draw the shortest path from home to school. 	
4. Identify open and closed paths. Example: Cross out the path that is not closed. 	AM 227
5. Identify whether an object is inside or outside of an enclosure.	AM 224
Measurement	
* 1. Demonstrate an understanding of comparative-height terms, short and tall.	
* 2. Demonstrate an understanding of comparative-linear terms, short and long.	
* 3. Demonstrate an understanding of comparative-weight terms, light and heavy.	
* 4. Demonstrate an understanding of comparative-size terms, big and little, large and small.	
* 5. Arrange three like objects in order of size.	
* 6. Identify which of two containers will hold the larger volume.	AM 249
* 7. Identify by name a penny, nickel, dime from pictures.	AM 188
8. Tell the value of a collection of 6 or fewer pennies.	
* 9. Name the days of the week in order.	

*Action Math

GRADE K

OBJECTIVE	REFERENCES AND RESOURCES
MEASUREMENT, (continued)	
10. Identify time on the clock as indicated by the hour hand.	
11. Measure an object with an arbitrary unit and a non-standard instrument and describe the object as longer or shorter than the instrument.	
Graphs, Charts and Tables	
* 1. Locate two objects from the perspective of one's being on the right, the other's being on the left.	
2. Complete simple graphs by coloring groups of five or fewer objects as directed.	

Example:

0	0	0	0	0	0	Color 1 red
0	0	0	0	0	0	Color 2 blue
0	0	0	0	0	0	Color 3 yellow
0	0	0	0	0	0	Color 4 black
0	0	0	0	0	0	Color 5 green

*Action Math

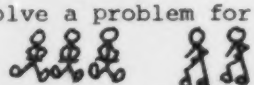
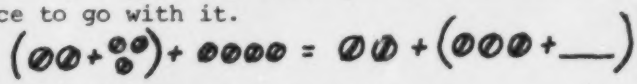
GRADE 1

GRADE 1

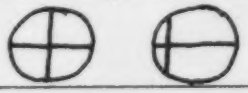
OBJECTIVE	REFERENCES AND RESOURCES
Mathematical Sentences	
1. Demonstrate understanding of the equality symbol (=).	* AM 24
2. Write a number sentence to name a number.	AM 46,48,144
* 3. Determine if a written number sentence using the numerals 0-10 is true or false. Example: 2 + 3 = 5 True 3 + 5 = 7 False	
* 4. Compute the missing addend or subtrahend in facts 0-10. Example: 3 + □ = 8 5 - □ = 2	AM 52,53,54,55,75,76 78
5. Supply the missing operational symbol (+ or -) in a number sentence. Example: 4 ○ 3 = 7	AM 50
* 6. Characterize the relationship between two numbers using the symbols <, =, >. Example: 6 > 4 6 = 6 6 < 7	AM 18,20,21 Stretch 8,9
Number and Numeration (Whole Numbers)	
1. Demonstrate understanding of one-to-one correspondence by counting or matching objects in sets.	AM 3,4,5
* 2. Count by ones in sequence to one hundred.	AM 157,158,162 Stretch 6,7
* 3. Count to 20 by twos and to 50 by fives.	AM 168,171 Stretch 3,5
* 4. Identify even and odd numbers to 10.	AM 165
* 5. Put missing numbers into sequences advancing by ones, twos, and fives with the beginning number other than 0.	AM 154
6. Tell the number which comes before or after a given number in an order relationship.	AM 160,161
* 7. Describe the position of an object in a set using the ordinal numbers first through tenth.	AM 212,213
* 8. Describe the number of tens and ones in any two-digit number and identify the numeral in either the ten's or the one's place. Example: a. 65 = 6 tens, 5 ones b. In 65 the 6 is in the ten's place and the 5 is in the one's place.	AM 89,91,93,97,104 Stretch 15

* Action Math

GRADE 1

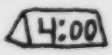
OBJECTIVE	REFERENCES AND RESOURCES
Number and Numeration (Whole Numbers), (continued)	
* 9. Compare two numbers (one- or two-digit) and determine which is the greater or which is lesser. Example: Circle the greater number. 58 (63)	
10. Recognize number words through ten.	AM 34,35
Operations	
1. Combine and separate sets as a preparation for addition and subtraction.	AM 65,66,81
* 2. Solve, both orally and in writing, basic addition and subtraction facts whose sums and minuends do not exceed 10.	AM 79,112-123, 146-150
3. Solve basic facts whose sums and minuends exceed 10.	AM 126,129 Stretch 10,16
* 4. Demonstrate understanding of the empty set by adding and subtracting problems containing zeros. Example: 1 + 0 = 1 0 + 2 = 2	AM 139
* 5. Demonstrate the commutative property for addition of whole numbers. Example: 3 + 2 = 2 + 3	AM 61,62,63,64
* 6. Write and solve a problem for a given illustration. Example:  3 + 2 = 5	AM 42,44,70,72 Stretch 11,26
* 7. Demonstrate the associative principle for addition of whole numbers by completing a set picture and the number sentence to go with it. Example:  (2 + 3) + 4 = 2 + (3 +)	

*Action Math

GRADE 1 OBJECTIVE	REFERENCES AND RESOURCES
Operations (continued)	
* 8. Add three numbers whose sum does not exceed 10.	AM 181,183 Stretch 12,13,14,19
9. Add four numbers in a column form.	AM 183,184 Stretch 20
*10. Add and subtract two-digit numbers when there is no regrouping.	AM 282,283,284,288, 289,290 Stretch 17
11. Explore the inverse relationship between addition and subtraction, using related facts.	AM 60,82
Rational Numbers	
* 1. Identify shapes which are divided into halves, thirds, and fourths. Example: Which shape shows fourths? 	AM 260,261,265 Stretch 29,31
2. Identify a fraction which names a designated part of a whole.	AM 262,263
Geometry	
* 1. Identify circles, squares, rectangles, and triangles when given models of geometric figures and an oral description of their properties.	AM 215,216,217,218, 219 Stretch 32,33,34,35
2. Identify objects that have the same shape.	AM 217,221
Measurement	
1. Measure length of objects by using non-standard units.	AM 240
* 2. Measure length in inches and centimeters.	AM 244,248 Stretch 43,47,48,49 50

*Action Math

GRADE 1

OBJECTIVE	REFERENCES AND RESOURCES
Measurement (continued)	
* 3. Tell time on a clock to the nearest hour and half-hour.	AM 208,210 Stretch 45
4. Read the time to the nearest hour and half-hour when it is written in standard notation. Example:  is four o'clock.	AM 206 Stretch 46
* 5. Identify representations of weeks, months, and days on a calendar.	AM 254 Stretch 42
* 6. Compare the relative weights (masses) of objects. Example: Mark the picture of the animal that weighs the most. 	Stretch 44,51
7. Measure capacity with pint and quart containers.	AM 249
8. Identify the value of a penny, a nickel, and a dime.	AM 188,199 Stretch 40
* 9. Count twenty-five cents using pennies, nickels, and dimes.	AM 186,187,190, 191,192 Stretch 38,39
10. Make change with pennies from dimes and nickels.	AM 201
Graphs, Charts, and Tables	
* 1. Distinguish between left and right, top and bottom.	
2. Read, interpret, or complete a simple bar graph using given data.	AM 277 Stretch 18

*Action Math

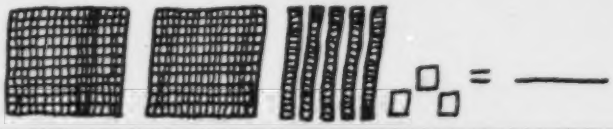
GRADE 2

GRADE 2

OBJECTIVE	REFERENCES AND RESOURCES
Mathematical Sentences	
* 1. Solve number sentences involving one placeholder with sums and minuends not exceeding 18. Example: a. $7 + \square = 10$ b. $11 - \square = 2$	*AM 52,53,54,55, 75,76
2. Solve number sentences with the placeholder in the minuend position. Example: $\square - 3 = 15$	AM 52,77
* 3. Solve number sentences using the symbols $>$ and $<$. Example: $17 > 15$ $63 < 81$	AM 18,20,21,22, 23
4. Use the symbols $>$ and $<$ to compare sums and differences. Example: a. $5 + 4 > 7$ b. $8 - 2 < 5 + 3$	AM 25,26
5. Solve sentences with more than one solution. Example: $\square + \Delta = 9$	AM 46
6. Solve sentences where the sum or difference comes before the equality sign. Example: a. $\square = 5 + 3$ b. $\square = 9 - 2$	AM 77
Number and Numeration (Whole Numbers)	
* 1. Read number names and write numerals to 200.	AM 166,167 Stretch 1,2,4,10
* 2. Count and write numerals to 100 by twos, fives and tens.	AM 169,170,172 Stretch 7,8
3. Write a number before or after a given number.	AM 160,161,162

* Action Math

GRADE 2

OBJECTIVE	REFERENCES AND RESOURCES
Number and Numeration (Whole Numbers) (continued)	
4. Write numerals for the missing numbers. Example: 35, 40, __, __, 55	AM 154
* 5. Distinguish between even and odd numbers.	AM 163,164
6. Complete a pattern counting by twos with odd numbers.	AM 163
7. Devise counting patterns by numbers other than twos, fives and tens.	AM 176
* 8. Use the ordinal numbers first through twentieth to describe the position of an object in a set.	AM 212,214
9. Recognize number words through 20.	AM 34,35
*10. Demonstrate the concept of place value through the hundreds. Example: 	AM 95
*11. Express a standard numeral in terms of hundreds, tens, and ones. Example: 365 = 3 hundreds, 6 tens, 5 ones	AM 89,91,93,98, 104
12. Identify the place value of a number in a standard numeral.	AM 90,97,104
13. Experiment with four-digit numbers.	AM 98,99,110
Operations (Whole Numbers)	
* 1. Display mastery of addition and subtraction facts having sums and minuends to 18 in both vertical and horizontal form.	AM 79,112,115,130, 134,136,137,138, 145,150,151

*Action Math

GRADE 2

OBJECTIVE	REFERENCES AND RESOURCES
Operations (Whole Numbers) (continued)	
* 2. Show understanding of the commutative principle for the operation of addition. Example: 4 + 5 = 5 + 4	AM 61,62,63,64
* 3. Display understanding of the associative principle for the operation of addition. Example: (4 + 1) + 2 = □ + (1 +2)	AM 181
4. Write four related sentences for addition and subtraction using basic facts. Example: 4 + 2 = 6, 2 + 4 = 6, 6 - 2 = 4, 6 - 4 = 2	AM 58,140,141, 142
* 5. Add 3 or more numbers written in either horizontal or vertical form. Example: 2 + 5 + 3 + 7 = 4 + 3 + 6	AM 181,182,183, 184
* 6. Add columns of numerals resulting in sums of not more than three digits and not including regrouping. a. 43 + 6 b. 86 +32 c. 43 +25 d. 154 +23 e. 436 +243 f. 11 + 56 + 22	AM 282,283,284, 288,290,293
7. Add columns of numerals resulting in sums of not more than three digits, including regrouping. a. 25 +9 b. 35 +18 c. 126 +49 d. 158 +227 e. 38 + 12 + 25	AM 285,286,287, 291,292,295, 296,297 Stretch 12,13,14, 15,38
* 8. Subtract two- and three-digit subtrahends from three-digit minuends, not including regrouping. a. 146 -13 b. 864 -352	AM 288,289,290

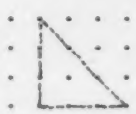
*Action Math

GRADE 2

OBJECTIVE	REFERENCES AND RESOURCES
Operations (Whole Numbers) (continued)	
9. Subtract numbers necessitating regrouping from the ten's place to the one's place. Example: a. 43 − 9 b. 62 − 35 c. 385 − 129	AM 287, 291, 292, 294 Stretch 15
*10. Write an equation to solve a simple word problem.	AM 43 Stretch 11, 15-16
*11. Solve problems containing a number of equal sets by skip-counting as an introduction to multiplication. Example: How many stars in 3 sets of 5 each? * * * *** *** *** * * *	Stretch 20, 21
12. Give evidence of understanding that multiplication is the repeated addition of the cardinal number of equivalent sets. Example: How many apples in three sets of 3 each? 3 + 3 + 3 = 9 3 x 3 = 9	AM 299, 300, 301
13. Experiment with multiplication problems, factors 5 or less.	AM 302,303,304,305, 306,310,311,313 Stretch 18, 19
Number and Numeration (Rational Numbers)	
* 1. Circle fractions that name shaded parts of objects, i.e. one-half, one-third, one-fourth and one whole.	AM 261, 263, 265 Stretch 26
2. Circle fractions that name more than one shaded part of an object. Example: $\frac{1}{3}$ $\frac{2}{2}$ $\frac{2}{3}$	AM 260, 262, 266
3. Circle a fractional part of a set. Example: Circle 1/3 of the X's X X X X X X X X X	AM 267 Stretch 28, 29

*Action Math

GRADE 2

OBJECTIVE	REFERENCES AND RESOURCES
Number and Numeration (Rational Numbers) (continued)	
4. Demonstrate an intuitive understanding of relative sizes of fractional parts. Example: a. $\frac{1}{2} > \frac{1}{3}$ b. $\frac{1}{3} > \frac{1}{4}$	AM 18,21,27
5. Read and write fractional numbers.	AM 262
Geometry	
1. Draw lines or line segments with a straight edge or ruler.	AM 234
* 2. Identify shapes: square, rectangle, triangle and circle; differentiate between open and closed curves.	AM 215,217,218, 219,226,227 Stretch 30,34
3. Construct geometric shapes between given points. Example: Draw 3 sides and 3 corners. 	AM 216 Stretch 32,33,35
4. Identify whether a point or object is inside, outside or on a simple closed curve.	AM 216,224
5. Identify sides and corners of geometric figures and count the number of each.	AM 216,226
6. Show an intuitive understanding of the properties of plane figures (square, rectangle, triangle, circle).	AM 216,226
7. Demonstrate the idea of congruence by selecting a figure that is the same size and shape as a given model.	AM 228,229
8. Identify unilateral symmetry in figures by marking those which could be equally folded or by drawing a missing part to make a figure symmetrical.	AM 230

*Action Math

GRADE 2

OBJECTIVE	REFERENCES AND RESOURCES
Measurement	
* 1. Name the days of the week, months of the year, and the four seasons.	Stretch 27, 45
* 2. Read and interpret a calendar.	AM 253, 254
* 3. Tell and write time to the nearest 15 minutes.	AM 206,207,208,210 Stretch 48, 49
* 4. Measure linear distance using units of inches and centimeters.	AM 245,246,248 Stretch 42,50,51, 52, 53
5. Recognize instruments used to measure feet, yards, and meters.	Stretch 43, 54
6. Measure to the nearest 1/2 inch.	AM 241,242,243 Stretch 40
* 7. Differentiate among the following measures: cup, pint and quart.	AM 249, 250
8. Use the half-pint, half-gallon, and gallon in measuring situations.	AM 249
9. Select an appropriately sized measuring device for capacity measure.	Stretch 55
* 10. Understand that pounds and kilograms are both measures of weight (mass). The pupil will demonstrate this understanding by giving an approximation of his own weight (mass) in pounds and kilograms.	Stretch 56
11. Recognize the symbols ¢ and $.	
12. Tell how many cents any coin represents.	AM 187,188,199 Stretch 39
13. Count collections of coins.	AM 190,191,192,187 196 Stretch 36, 41
* 14. Make change for 5¢, 10¢, 25¢ and 50¢.	AM 201
15. Identify dozen and half-dozen in a set of objects.	
16. Select a measuring instrument appropriate to the situation.	

*Action Math

GRADE 2

OBJECTIVE	REFERENCES AND RESOURCES
Graphs, Charts and Tables	
1. Read and interpret a simple bar graph.	AM 270
2. Construct a bar graph with data gathered from the immediate environment.	AM 271 Stretch 5,6

GRADE 3

GRADE 3

Mathematical Sentences

* 1. Solve problems using placeholders, involving one- and two-digit numerals in addition and subtraction, no regrouping. Example: □ - 6 = 8 □ + 8 = 17 □ + 20 = 52	* AM 52,53,54,75,76 77
2. Solve problems using placeholders, involving multi-digit numerals in addition and subtraction, with regrouping. Example: □ - 14 = 36 □ + 25 = 71 5□24 +2825 = 8549 45□ -219 = 234	AM 53,77
3. Solve problems by finding the missing factors for basic facts. Example: □ x 3 = 12	AM 54,77
4. Solve sentences where the sum, difference, or product comes before the equality sign. Example: □ = 7 + 8 □ = 12 - 8 □ = 1 x 8	AM 54,77
5. Solve an open sentence involving inequalities. Example: 6 + □ > 8 25○9 x 3	

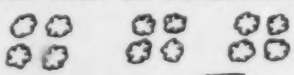
* Action Math

GRADE 3

OBJECTIVE	REFERENCES AND RESOURCES
Mathematical Sentences (continued)	
6. Solve more elaborate number sentences. Example: $\square + 6 = 5 + 7$ $4 + 3 = 8 - \square$	AM 356
7. Write the correct symbol ($<$, $>$, $=$) to compare sums, differences, and products. Example: $46 + 37 \bigcirc 45 + 36$	AM 25,26
Number and Numeration (Whole Numbers)	
* 1. Read and write numerals through the thousands.	AM 89,110,157 Stretch 3,4
2. Read and write a numeral for a number less than 1,000,000.	AM 89,101,110,157
3. Identify the million's place.	AM 90,91,93,96,101
4. State the value of each digit in a six-digit numeral.	AM 97,100,101,104, 111
* 5. Write three- and four-digit numerals in expanded notation. Example: 1,324 = 1,000 + 300 + 20 + 4 1,320 1,000 + 3-0 + 20 + 4 2,417 two thousand, four hundred seventeen	AM 90,91,93,98,99, 106,108 Stretch 31,32
* 6. Write a numeral for a number which is 10 more or 100 more than a given number. Example: 263 (10 more) 273 263 (100 more) 363	
7. Write numerals for the missing numbers in any sequence of numbers through four-digits. Example: 3267, 3271, $\square$, $\square$, $\square$, 3287, 3291	AM 155,161,162
8. Count and order numbers less than 10,000 by ones, twos, fives, tens, hundreds, or thousands. Example: 20, 30, $\square$, $\square$ 90, 190, 290, $\square$, $\square$ 230, 1,230, 2,230, $\square$, $\square$	AM 87,155,157,168, 169,170,172,173 174,175,180

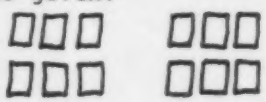
*Action Math

GRADE 3

OBJECTIVE	REFERENCES AND RESOURCES
Number and Numeration (Whole Numbers) (continued)	
9. Recognize and use ordinal numbers first through thirtieth to identify position.	AM 214
10. Identify any two- or three-digit number as odd or even.	AM 163,164,355 Stretch 1
*11. Display mastery of Roman numerals through 10.	AM 38,39
12. Round a two-digit number to the nearest 10 and a three-digit number to the nearest 100.	AM 342
Operations (Whole Numbers)	
* 1. Master the 100 basic addition and related subtraction facts.	AM 79,115,137,138, 149,153 Stretch 7
* 2. Write related addition and subtraction sentences for three numbers, using both inverse operations and the commutative principle. Example: Given 3, 4, 7 3 + 4 = 7 4 + 3 = 7 7 - 4 = 3 7 - 3 = 4	AM 60,140,141,142
* 3. Solve examples containing two three-digit addends with regrouping from the one's place to the ten's place and from the ten's place to the hundred's place, demonstrating thereby an understanding of regrouping in addition.	AM 291,294,295, 296,297
* 4. Solve subtraction problems containing three-digit numerals with regrouping in the ten's and one's place.	AM 42,43,295,296, 297
5. Add or subtract any combination of two- and three-digit numbers, thereby demonstrating understanding of when or when not to regroup.	AM 291,294,295, 296,297
6. Understand that the same methods used in addition to rename and compute smaller numbers can be used for larger numbers (commas reviewed). Example: 82,456 +43,829	
7. Subtract numbers involving renamings with zeros.	AM 79
* 8. Write an addition problem to show multiplication as repeated addition when an illustration of equal groupings is given.  Example: 4 + 4 + 4 = 12 3 x 4 = 12	AM 300,301

*Action Math

GRADE 3

OBJECTIVE	REFERENCES AND RESOURCES
Operations (Whole Numbers) (continued)	
* 9. Display mastery of the multiplication facts of 0 through 5.	AM 79,115,302,303,311, 318,326 Stretch 15
*10. Write a subtraction problem to show division as repeated subtraction when an illustration of equal groupings is given. Example:  12 ÷ 3 = 4 12 -3 9 -3 6 -3 3 -3 0	
11. Complete multiplication and division sentences for facts of 6 through 9.	AM 115,305,306,315,316, 317,323,324,327,328, 329,335,336,337,338, 339 Stretch 12,13
*12. Give evidence of understanding the commutative principle as it relates to multiplication. Example: 3 x 5 = 5 x □ □ x 2 = 2 x □	AM 46,62,63,64
13. Give evidence of understanding the associative property as it relates to multiplication and addition. Example: (3 + 4) + 7 = 3 + (4 + 7) (2 x 3) x 6 = 2 x (3 x 6)	AM 181,320
14. Write multiplication and division sentences for arrays.	AM 48,299
*15. Identify number sentences which reveal the inverse relationship between multiplication and division. Example: If 3 x □ = 12, then 12 ÷ 3 = □	AM 59,60

*Action Math

GRADE 3

OBJECTIVE	REFERENCES AND RESOURCES
Operations (Whole Numbers) (continued)	
16. Complete the related multiplication and division sentences for basic facts. Example: Given 8, 3, 24 8 x 3 = 24 24 ÷ 3 = 8 3 x 8 = 24 24 ÷ 8 = 3	AM 140,141,307,308,325
17. Multiply three numbers using basic facts. Example: 4 x 2 x 6 = ☐	AM 181,183,184
18. Multiply 10 or 100 by a number less than 100. Example: 84 x 10 = ☐ 58 x 100 = ☐	AM 149,280
19. Multiply a multiple of 10 or 100 by a number less than 10. Example: 2 x 60 = ☐ 4 x 90 = ☐	AM 149,280 Stretch 11
*20. Multiply a three-digit factor by a one-digit factor with regrouping from the one's place to the ten's place and from the ten's place to the hundred's place.	AM 319 Stretch 16
*21. Solve even-division problems containing three-digit dividends and divisors of from 2 through 5.	AM 330
22. Solve division problems containing one- and two-stage division, with and without remainders. Example: $5\overline{)48}$ 9 R.3, 45, 3 ; $3\overline{)51}$ (Tens | Ones) 17, 3↓, 21, 21, 0 ; $6\overline{)74}$ 12 R.2, 6↓, 14, 12, 2 ; $34\overline{)68}$ 2, 68, 0	AM 330,331,332,334 Stretch 14
23. Prior to solving problems, estimate the answer. Example: 67 Estimate 70, +34, +30 ; 342 Estimate 300, +475, +500	AM 341 Stretch 44

*Action Math

GRADE 3

OBJECTIVE	REFERENCES AND RESOURCES
Operations (Whole Numbers) (continued)	
*24. Not only identify addition and subtraction operations in problem-solving situations but also write the equation to express them.	AM 69,71 Stretch 9,18,20
25. Identify and write equations in problem-solving situations for all operations.	AM 69,312,313 Stretch 17,25
Number and Numeration (Rational Numbers)	
* 1. Identify fractional parts of halves, thirds, fourths fifths, sixths, and eighths.	AM 264,265,266
2. Understand the concept of order in a set of fractional numbers. Example: $\frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{4}{4}$	
3. Write a fraction for a shaded region or for part of a set. Example: $\frac{3}{4}$ $\frac{3}{5}$ are shaded.	AM 261,262
4. Identify the number of equivalent parts in a region and write fractions equal to 1. Example: ← 3 equal parts $1 = \frac{1}{1}$ $1 = \frac{6}{6}$	AM 264
5. Compare fractions with the aid of a model using like or different denominators. Use the signs >, =, <. Example: $\frac{1}{3} < \frac{2}{3}$ $\frac{1}{2} = \frac{\square}{6}$	AM 260 Stretch 29
6. Write a mixed number for the shaded parts of a region. Example: $1\frac{1}{4}$	

*Action Math

GRADE 3

OBJECTIVE	REFERENCES AND RESOURCES
Number and Numeration (Rational Numbers) (continued)	
7. Understand the concept that $\frac{1}{3},\frac{1}{4},\frac{1}{5}$ illustrate dividing by 3, 4, and 5.	Stretch 27,28
Geometry	
* 1. Identify and draw simple closed-plane curves.	AM 216,217,218,219, 223,227,235,236 Stretch 38
2. Identify whether a point or object is inside, outside, or on a simple closed curve.	AM 216,224,226
3. Identify angles and right angles.	AM 226
4. Find, count, and write the number of sides and corners in a geometric figure.	AM 216,270
5. Find a figure congruent to a given one.	AM 228,229
6. Identify and draw line segments and congruent line segments.	Stretch 35
7. Identify and draw a diagonal in a geometric figure.	
8. Identify a cube.	AM 220,221 Stretch 36,39
Measurement	
* 1. Read a clock to the nearest 5 minutes.	AM 204,205,207,209, 210
2. Compute time on a clock. Example: It is 3:20. What time will it be in 15 minutes?	Stretch 54,55
3. Understand the concept of a.m. and p.m.	Stretch 53,54

*Action Math

GRADE 3

OBJECTIVE	REFERENCES AND RESOURCES
Measurement	
4. Describe the length or width of an object using a non-standard unit (arms, hands, feet, fingers, etc.).	AM 240
* 5. Measure yards, feet, inches, half-inches, meters, and centimeters.	AM 241,242,243,246, 248 Stretch 40,41,42,43, 44,49,50,51, 52
6. Choose an appropriate customary or metric unit of length for a given measurement.	AM 244
7. Find the perimeter of a figure in centimeters and customary measurements.	AM 226,257,258
8. Find an area by counting square units (centimeter squares inside a region).	AM 226,231,233 Stretch 37
9. Find volume by counting cubic units.	AM 232,238
*10. Differentiate among gallons, quarts, pints, cups, half-gallons, and liters.	AM 249 Stretch 46
*11. Differentiate among pounds, half-pounds, quarter-pounds, ounces, grams, and kilograms.	Stretch 47
12. Give equivalent measures for simple units of length, weight, and capacity.	AM 250
*13. Make change up to $1.	AM 187,201
14. Count a sum of money and record the amount, using the dollar sign and the cents point.	AM 186,187,190,202
*15. Add and subtract money values up to $5.	AM 195
16. Tell temperature using the Fahrenheit and Celsius systems and identify freezing and boiling points.	AM 255,256 Stretch 34,48,53
17. Extend understanding of a calendar to include the holidays.	
Graphs, Charts, and Tables	
1. Interpret, read, and construct simple tables, bar graphs, pictographs, and schedules.	AM 270,271,278 Stretch 6, 53

*Action Math

GRADE 3

OBJECTIVE	REFERENCES AND RESOURCES
Graphs, Charts, and Tables (continued)	
2. Use data in graphs, charts, and tables to find sums and differences.	AM 315 Stretch 33
3. Find location (on a grid) by using ordered pairs of numbers.	AM 273,274,275,276

GRADE 4

GRADE 4

Mathematical Sentences	
1. Create number sentences including both whole numbers and fractions.	
2. Complete problems by supplying the missing number when the placeholder is in a variety of positions. Example: $7 + \square = 12 - 3$ $17 - \square = 11 - 3$ $\square = \frac{8}{2}$ $73\square 1 + \square 689 = 9\square 2\square$	
3. Substitute letters for placeholders. Example: $\$1.42 + n = \$3.50$	
Number and Numeration (Whole Numbers)	
* 1. Extend a given sequence of numbers in either a negative direction to zero or a positive direction to 999,999.	* AM 155,179
2. Read and write numerals through the millions.	AM 89,101,110,157 Stretch 2
* 3. Identify the place value and face value for each digit in any five-digit numeral.	AM 97,98,99,100,101, 104,111
* 4. Write four- and five-digit numerals in expanded notation.	AM 106,108
5. Extend place value to include millions. Example: 8 tens, 9 thousands, 3 millions, 7 hundreds, 4 hundred thousands, 2 ones, 3,409,782	AM 90,91,93,96,98

* Action Math

GRADE 4

OBJECTIVE	REFERENCES AND RESOURCES
Number and Numeration (Whole Numbers) (continued)	
* 6. Write Roman numerals to 50.	AM 38,39
7. Insert the correct relational symbol (<, =, >) between two computed answers. Example: 8075 − 3921 ◯ 9781 − 2305	AM 25,26
8. Demonstrate an ability to round off numbers to the nearest thousand.	
9. Demonstrate understanding of the greatest common divisor and properties of 1 and 0.	
10. Display understanding of zero as a factor.	AM 310
11. Identify a number less than 1,000,000 as odd or even.	AM 163,164
Operations (Whole Numbers)	
* 1. Solve addition examples involving three addends of four digits each with regrouping in the ten's, hundred's, and thousand's places.	AM 295,296,297 Stretch 4
* 2. Solve subtraction examples containing four-digit numerals with regrouping in the one's, ten's, and hundred's places.	AM 295,296,297
3. Add or subtract any two whole numbers less than 1,000,000 with or without regrouping.	AM 295,296,297 Stretch 14,104,5,6
4. Supply a missing number to solve an equality, with or without regrouping. Example: 4 + 3 = 9 − □ 8 x 6 = 36 + □ 18 ÷ 3 = □ x 3	AM 46,54
* 5. Mastery of the 100 multiplication and division facts.	AM 79,115,149,306,311, 316,317,334,335, 336,337,338,339
* 6. Solve multiplication problems containing two-digit multiplicands and a two-digit multiplier with regrouping.	AM 319 Stretch 29,34
7. Understand and solve problems with ratios and equal ratios.	

*Action Math

GRADE 4

OBJECTIVE	REFERENCES AND RESOURCES
Operations (Whole Numbers) (continued)	
8. Understand and solve problems involving multiples of 10 Example: 92 x 1000 = 90 x 500 = 432 x 30	AM 280
9. Extend multiplication problem-solving to include four-digit multiplicands by one-digit multipliers and three-digit multiplicands by two-digit multipliers, with regrouping.	
*10. Solve both even- and uneven-division problems containing three-digit dividends and one-digit divisors.	AM 330,331,332,334 Stretch 34,35,36
11. Extend problem solving of even- and uneven-division problems to include four-digit dividends by one-digit divisors and three-digit dividends by two-digit divisors.	AM 330,331,332,334 Stretch 37,38
*12. Be able to compute with zeros in any four-digit numeral in any of the four basic operations.	
13. Recognize the value of the commutative and associative laws and the special properties of 1 and 0 for simplifying problem solving.	
14. Solve equations with parenthesis involving addition, subtraction, multiplication and division. Example: (18 ÷ 6) + 3 = 58 x (3 + 4) =	
15. Understand and calculate averages.	Stretch 44,46
16. Estimate answers in all four operations.	AM 341 Stretch 32
17. Solve word problems by separating out pertinent facts from given information.	
18. Solve one- and two-step word problems using the four basic operations. Write number sentences to solve the problem.	AM 42,43,71,312 Stretch 11,21,43,89, 90,91,94,95, 96,22
Number and Numeration (Rational Numbers)	
1. Understand the terms numerator and denominator.	

*Action Math

GRADE 4

OBJECTIVE	REFERENCES AND RESOURCES
Number and Numeration (Rational Numbers) (continued)	
* 2. Identify points on a number line with the appropriate mixed-number name, demonstrating thereby an understanding of mixed numbers.	
* 3. Insert the correct relational symbol ($<$, $=$, $>$) between a pair of given fractions.	AM 18,21,27,260,268, 269 Stretch 50
4. Identify and write a fraction equivalent to a given fraction.	
5. Read and write decimal fractions to the hundredth's place. (.01).	
6. Understand the position of the decimal point as locating the one's place.	
7. Write a decimal fraction for a mixed numeral. Example: $25\frac{7}{10} = 25.7$	
8. Develop understanding of the decimal qualities as related to the U.S. Monetary System.	
Operations (Rational Numbers)	
1. Identify and write a fractional part of a number. Example: $\frac{1}{5}$ of 10 $\quad\quad$ $\frac{3}{4}$ of 12	
* 2. Compute the sum of two like fractions.	
* 3. Compute the difference for two like fractions not involving regrouping.	
4. Add and subtract fractions with mixed numerals having like denominators.	Stretch 51
5. Add and subtract unlike fractions; the common denominator is present in the problem.	Stretch 51
6. Rename a mixed number as an improper fraction and vice versa.	
7. Find the greatest common divisor.	
8. Add and subtract decimal fractions to the hundredth's place, with renaming.	Stretch 52

*Action Math

GRADE 4

OBJECTIVE	REFERENCES AND RESOURCES
Geometry	
1. Understand points as exact locations in space and understand space as the set of infinite points.	Stretch 102
* 2. Use accurately the terms point, line, line segment, and ray.	AM 234
* 3. Classify quadrilaterals as squares, rectangles, or parallelograms.	AM 217,239 Stretch 74
4. Identify a pair of lines as parallel or intersecting.	
5. Define angles and right angles as the union of two rays having a common endpoint. Understand the concept of vertex.	
6. Identify triangles, pentagons, and hexagons.	AM 217,218,235,236 Stretch 75,77,79,80
7. Use a straight edge and compass to measure and draw line segments.	
8. Understand and apply the term congruent to any plane and solid geometric figures.	AM 228,229
9. Identify the center, radius, and diameter of a circle.	AM 237
10. Identify horizontal and vertical lines.	
11. Identify the shape of a three-dimensional object (rectangular prism, cylinder, cone, sphere, cube, and pyramid).	AM 217,220,221,222,223
12. Identify and draw lines of symmetry.	AM 230
13. Find the perimeter of polygons.	AM 226
14. Find the perimeter and area of squares and rectangles.	AM 226
Measurement	
* 1. Tell time using seconds, minutes, hours, days, and years.	AM 204,205,207,209,210 Stretch 87,88
2. Extend telling time to include century.	Stretch 86
3. Know when to use a.m. and p.m.	
4. Relate amounts of time in terms of hours and minutes using the addition and subtraction algorithms. Example: 20 minutes later than 2:05 35 minutes earlier than 6:47	

*Action Math

GRADE 4

OBJECTIVE	REFERENCES AND RESOURCES
Measurement (continued)	
* 5. Make change up to $10.	AM 187,201
* 6. Add, subtract, and multiply money values up to $10.	AM 195
7. Extend problem solving of money values shown as decimals to include division and values over $10.	Stretch 4,12,13,20
* 8. Find equivalent measures for dry weight using ounces, pounds, and tons. Example: one pound equals _____ ounces.	
* 9. Find equivalent liquid measures for cups, pints, quarts, and gallons. Example: Six cups equal _____ pints.	AM 250
*10. Measure linear distances in inches, feet, and yards to the quarter inch; understand the concept of miles as a linear measurement.	Stretch 81
11. Extend measurement to include one-eighth inch.	AM 241,242,243
*12. Find perimeters using metric or customary linear units of measurement.	AM 257,258
*13. Measure linear distances in meters and centimeters.	AM 244,246
14. Describe the length of an object to the nearest millimeter.	
15. Find the area (square measures) of a region with customary and metric measurements.	AM 231,232,233 Stretch 82
*16. Measure volume and mass in liters, kiloliters, grams, and kilograms.	AM 251
17. Find the volume of a rectangular prism with metric and customary measurements.	AM 238 Stretch 78
18. Choose an appropriate metric unit of length or weight to measure a given object.	Stretch 84
19. Complete a table of equivalent measures for any given unit of measurement.	AM 247,250
20. Determine temperature on a Celsius and a Fahrenheit thermometer.	AM 255 Stretch 85
21. Solve word problems involving measurement.	Stretch 97,99

*Action Math

GRADE 4

OBJECTIVE	REFERENCES AND RESOURCES
Graphs, Charts, and Tables	
1. Interpret, read, and construct simple bar and picture graphs.	AM 278
2. Locate points on a coordinate plane as a preliminary to graphing.	AM 273,274,275,276
3. Interpret, read, and construct line graphs.	
4. Complete function tables and charts for all processes.	Stretch 6,7,9,14,39, 92
5. Interpret and read a time schedule.	

GRADE 5

GRADE 5

Mathematical Sentences	
1. Understand mathematical sentences extended to include decimal numerals.	
2. Write a number sentence to solve a word problem.	
Number and Numeration (Whole Numbers)	
1. Understand numbers, both reading and writing, through billions.	
*2. Identify the place value for each digit in any six-digit numeral.	Stretch 1,2,3
3. Use an exponent in expanded notation and cubic measurement (metric).	
4. Understand expanded notation.	
*5. Understand prime and composite numbers.	
6. Find common multiples of two numbers.	
7. Find the least common multiple of two numbers.	
*8. Determine by inspection if a number is divisible by 2, 5, or 10.	
*9. Read and write Roman numerals through one hundred.	
*10. Round whole numbers to the nearest 10, 100, 1000.	Stretch 75,45

*Action Math

GRADE 5

OBJECTIVE	REFERENCES AND RESOURCES
Operations (Whole Numbers)	
* 1. Add whole numbers whose addends do not exceed five digits.	Stretch 4-13,19-21, 41
* 2. Subtract whole numbers whose subtrahend and minuend do not exceed five digits.	Stretch 13-15,17,22, 33,37,41
* 3. Give orally or in writing the products for randomly selected multiplication facts.	
* 4. Multiply using one-, two-, and three-digit multipliers.	Stretch 19-21,23-32, 34,41,90
* 5. Use examples to demonstrate that multiplication is both a commutative and an associative process.	
* 6. For any given number, write number sentences that illustrate the identity element for multiplication and the zero property for multiplication.	
* 7. Give orally or in writing the quotient for randomly selected division facts.	
* 8. Divide with one- and two-digit divisors and five-digit dividends, all difficulties.	Stretch 33-41,89,90
9. Check addition, subtraction, multiplication and division problems. Casting out 9's is one method. Realize that estimation is one way to check the reasonableness of an answer.	
10. Solve one-, two-, and three-step word problems using the four basic processes. Write number sentences to solve the problem.	Stretch 4,12,13,15, 20-27,29,30, 32-34,36,38, 40,43,44,53, 89,91,92,97, 98
11. Use estimation and approximation in problem computing (addition, subtraction, multiplication, and division) and solving as well as in checking an answer.	Stretch 32

*Action Math

GRADE 5

OBJECTIVE	REFERENCES AND RESOURCES
Number and Numeration (Rational Numbers)	
* 1. Give orally or in writing the place value for each digit in a decimal numeral not to exceed hundredths.	
2. Use a number line to help explain fractions (common and decimal.)	
3. Arrange fractional numbers in order from smallest to largest and largest to smallest.	
4. Arrange decimal numbers in order from smallest to largest and largest to smallest.	
5. Round decimals to the nearest whole number.	
Operations (Rational Numbers)	
1. Determine if a given fractional number is expressed in its simplest form.	
* 2. Write the correct mixed numeral for a given improper fraction or the correct improper fraction for a mixed numeral.	
3. Find equivalent fractions and a method of checking for equivalence.	Stretch 50
* 4. Compute the sum of two fractions or mixed numbers with common denominators. Give all answers in lowest terms.	
* 5. Compute the differences of two fractions or mixed numbers with common denominators, all regrouping difficulties, all answers given in lowest terms.	
6. Compute the sums and differences of fractions and mixed numbers when denominators are different but the common denominator is present.	
7. Compute the sums and differences of fractions and mixed numbers with unlike denominators when the common denominator is not present.	
8. Compute the sum and differences of mixed numbers, renaming difficulties to be included.	Stretch 47,48,51
* 9. Compute the product of any two fractions.	
10. For a given situation, write equivalent ratios.	
11. Rename the remainder in division as a fraction (in lowest terms).	

*Action Math

GRADE 5

OBJECTIVE	REFERENCES AND RESOURCES
Operations (Rational Numbers) (continued)	
*12. Compute the sums and differences for decimal numerals which contain no more than two decimal places.	Stretch 52,82
13. Multiply decimals, including annexing zeros to the product.	
14. Divide decimals with decimal places in the dividend only.	
15. Determine the reciprocal of a fraction or whole number.	
16. Use estimation with decimals.	
17. Compare and order decimals.	
18. Solve word problems using fractions and decimals.	
Geometry	
* 1. Understand the extended concepts of points, space, line segments, lines, rays, angles (acute, obtuse, right, straight), sides, planes, faces, and vertices.	Stretch 74
* 2. Understand the concepts of intersecting, parallel, and perpendicular lines.	
3. Understand the concept of congruency of angles, line segments, and figures.	
4. Understand the concept of symmetry.	
* 5. Define a circle and use accurately the descriptive terms center, radius, circumference, and diameter.	
6. Understand how to use a protractor to measure and draw angles.	
7. Understand how to use a compass in constructing a circle and a congruent angle and in bisecting a line segment and an angle.	
8. Identify simple closed curves (paths).	
9. Identify geometric figures: polygons, pyramids, cylinders, cones, and spheres.	Stretch 75,77,79,80
*10. Compute the area and perimeter of rectangles and squares.	Stretch 76,78,82
11. Compute the volume for quadrilaterals.	

*Action Math

GRADE 5

OBJECTIVE	REFERENCES AND RESOURCES
Geometry (continued)	
12. Compute the circumference of a circle.	
13. Locate points on a grid, given number pairs. Name number pairs for points on a grid.	
Measurement	
1. Understand the approximate nature of measurement.	
2. Know and understand the U.S. customary system of measurement. Length: inch, feet, yard, and mile. Weight: ounce, pound, and ton. Capacity: cup, half-pint, pint, quart, half-gallon, and gallon. Temperature: Fahrenheit. Square and cubic measurement.	Stretch 18
* 3. Know and understand the metric system. Length: millimeter, centimeter, decimeter, meter, kilometer. Mass (Weight): milligrams, grams, kilograms. Capacity: milliliter, liter, kiloliter. Temperature: Celsius. Square and cubic measurement.	Stretch 18,83-85
4. Make conversion among customary units and metric units. 25 cm = 2.5 dm 134 in. = 11 ft. 2 in.	Stretch 81
5. Compute the perimeter, area, and volume of quadrilaterals in U.S. customary system and metric system.	Stretch 76,78,82
6. Compute circumference using $C = \pi d$.	
* 7. Compute the average for a group of like measurements, (height, mass, etc.).	Stretch 46
8. Compute time, rate, and distance.	
9. Work with the protractor to develop concepts of angle and degrees.	
10. Work with decimals and fractions in computing measurement.	Stretch 46
11. Know and understand the measurement of time: second, minute, hour, day, week, month, year, and century.	Stretch 86-88

*Action Math

GRADE 5

OBJECTIVE	REFERENCES AND RESOURCES
Measurement (continued)	
12. Know and understand the U.S. monetary system. Write specific amounts. Use specific amounts in the processes of addition, subtraction, multiplication, and division. Make change.	Stretch 12,13,20,39, 56
13. Estimate time and length.	
Graphs, Charts, and Tables	
1. Interpret tables, schedules, graphs (pictographs, bar graphs, line graphs, circle graphs) and coordinate grids.	Stretch 46
2. Construct bar graphs, line graphs, and coordinate grids.	Stretch 46,61-71
3. Understand scale drawing and draw simple scale drawings.	Stretch 72,73
4. Understand the use of legends.	
5. Solve word problems using tables, schedules, and graphs.	

GRADE 6

84

GRADE 6

OBJECTIVE	REFERENCES AND RESOURCES
Mathematical Sentences	
1. Understand and use number sentences related to all operations involving equalities and inequalities.	
2. Understand and use sentences to solve ratios and percentage problems and to find perimeter, area, volume of geometric figures.	
3. Understand and use number sentences to solve word problems.	
4. Understand and use number sentences when working with integers.	
Number and Numeration (Whole Numbers)	
* 1. Translate a word description of a number through millions into the standard numeral.	Stretch 1-3
2. Understand expanded and scientific notation as a way to rename a numeral. $(1,000,000) = 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 10^6$ $5280 = (5 \cdot 10^3) + (2 \cdot 10^2) + (8 \cdot 10^1) + (0 \cdot 10^0)$	
* 3. Identify any whole number as either prime or composite.	
* 4. Convert a given composite number into a product of prime numbers by factoring. Use exponents.	
5. Find the GCF (greatest common factor) of two numbers.	
6. Find the LCM (least common multiple) of two numbers.	
7. Know the divisibility rules for 2, 5, 10, 3 and 9.	

*Action Math

GRADE 6

OBJECTIVE	REFERENCES AND RESOURCES
Operations (Whole Numbers)	
* 1. Add whole numbers with all regrouping difficulties.	Stretch 4-13,17,19-21,41
* 2. Subtract whole numbers with all regrouping difficulties	Stretch 13-15,17,22 33,37,41
* 3. Compute the products for multiplication examples with four place multiplicands and up to three place multipliers.	Stretch 19-32,34,90
* 4. Compute the quotients for division examples whose dividends do not exceed five-digits and whose divisors do not exceed two-digits.	Stretch 33-41,89,90
5. Do the above four processes when numbers are given in equation form.	
6. Add and subtract negative numbers.	Stretch 16-18
7. Use estimation and approximation in problem-solving situations as well as in proving if an answer is reasonable (checking).	Stretch 32
* 8. Demonstrate the distributive property as it relates to multiplication using an expanded algorithm. $36 \cdot 24 = (36 \cdot 20) + (36 \cdot 4)$	
* 9. Solve word and thought problems involving two or more steps using the four basic processes.	Stretch 12,29,30,33, 43,44,46,53, 89,91,92,94-97,99,104
Number and Numeration (Rational Numbers)	
* 1. Extend decimal place value through the millionths.	
2. Extend the understanding of the relationship among fractions, decimals and percentages.	Stretch 54
* 3. Arrange any given set of fractional numbers in order from largest to smallest or smallest to largest.	
4. Arrange any given set of decimal numbers in order from largest to smallest or smallest to largest.	

*Action Math

GRADE 6

OBJECTIVE	REFERENCES AND RESOURCES
Number and Numeration (Rational Numbers) (continued)	
* 5. Convert fractions, decimals, percents and ratios to equivalents.	
* 6. Given a decimal number with no more than three decimal places, round the number to the nearest tenth and hundredth.	Stretch 45
Operations (Rational Numbers)	
* 1. Compute the sums in problems involving fractional numerals or mixed numerals with unlike denominators, all difficulties. Express answers in simplest form.	Stretch 47,48,51
* 2. Compute the differences in problems involving fractional numerals or mixed numerals with unlike denominators, all difficulties, including regrouping. Give answers in simplest form.	Stretch 47,48
3. Compute addition and subtraction problems in column and equation form.	
* 4. Compute products of two fractions or mixed numbers.	
* 5. Compute the quotient of two fractional numbers or mixed numbers.	
6. Determine if a given fractional number is expressed in its simplest form.	
7. Convert any given improper fraction to its equivalent mixed-number form and vice versa.	
* 8. Compute the sums for decimals extending to the thousandths.	Stretch 52
* 9. Compute the differences for decimals extending to the thousandths.	
*10. Compute the product for decimal numerals whose products will contain up to four decimal places.	
*11. Divide decimals, with decimal place in both divisor and dividend, and demonstrate correct use of the caret.	Stretch 54,56-61
12. Solve percentage problems involving all cases.	
13. Understand ratio as a useful problem-solving method.	
14. Find missing numbers in equal ratios (proportions).	

*Action Math

GRADE 6

OBJECTIVE	REFERENCES AND RESOURCES
Operations (Rational Numbers) (continued)	
15. Use fractions, decimals, and percentages in solving word problems.	Stretch 53,54,56-58, 60
16. Use estimation with fractions and decimals.	
Geometry	
1. Review basic geometric concepts of points, space, planes, lines, line segments, rays, angles (acute, obtuse, right, and straight), parallel lines, perpendicular lines, intersecting lines, faces and vertices.	Stretch 74,75,77,79, 80,102,103
2. Review the concept of congruency of angles, line segments, and figures.	
3. Review and extend the concept of symmetry.	
4. Review the parts of a circle, and accurately use the descriptive terms: center, radius, circumference, and diameter. Know that a circle has 360°.	
5. Identify simple closed-curve paths.	
6. Know the names and definition of geometric figures: polygons, triangles (equilateral, isosceles, and scalene), pyramids, cylinders, cones, and spheres.	
7. Know how to use a protractor to measure and draw angles.	
8. Know how to use a compass in constructing a circle and in bisecting a line segment and an angle.	
9. Know how to find the third angle of a triangle when the measures of two angles are given.	
*10. Compute problems using formulas for finding the perimeters and areas of triangles, squares, circles, and rectangles.	Stretch 76,78,82
11. Compute problems using formulas for finding volume of rectangular solids and cylinders.	
*12. Name number pairs for points on a grid. Locate points on a grid, given numbered pairs.	Stretch 62-71

*Action Math

GRADE 6

OBJECTIVE	REFERENCES AND RESOURCES
Measurement	
1. Understand the approximate nature of measurement.	
2. Know and understand the U.S. customary system of measurement. Length: inch, feet, yard, and mile. Weight: ounce, pound, and ton. Capacity: cup, half-pint, pint, quart, half-gallon, gallon. Temperature: Fahrenheit. Square and cubic measurement.	Stretch 23,73,81
3. Know and understand the metric system. Length: millimeter, centimeter, decimeter, meter, dekameter, hectometer, and kilometer. Mass (Weight): milligram, grams, and kilograms. Capacity: milliliter, liter, and kiloliter. Temperature: Celsius. Square and cubic measurement.	Stretch 81,83-85
4. Make conversion within customary units and metric units 25 cm = 2.5 dm 134 in. = 11 ft. 2 in.	
* 5. Compute addition and subtraction problems using metric and customary measurement.	Stretch 99
6. Compute the perimeter, area, and volume of shapes (circle, square, triangle, and solid prisms), using customary and metric systems.	Stretch 78,82,83
7. Solve word problems involving measurement: time, distance, averaging, money, etc.	Stretch 23
8. Know and understand the measurement of time.	Stretch 86-88
9. Know and understand the monetary system of the U.S. Write specific amounts. Use the processes of addition, subtraction, multiplication, and division when dealing with money. Make change.	Stretch 12,13,20,39, 56
10. Use estimation when working with measurement.	
Graphs, Charts, and Tables	
* 1. Read tables, schedules, graphs (pictographs, bar graphs, line graphs, and circle graphs), and coordinate grids.	Stretch 46,59
2. Construct bar, line, and circle graphs, and coordinate grids.	Stretch 46,59,61-71
3. Understand and make scale drawings.	Stretch 72,73

*Action Math

APPENDIX

Materials and equipment available to assist in teaching elementary school mathematics.

A. The following materials are available in the Denver Public Schools warehouse. Ordering information is included with the description of the items.

Action Math:

A collection of 356 mathematics games and activities designed to be used with grades 1-3 and adaptable to grades 4-6. These games and activities are easily constructed by the teacher and stress the use of concrete objects for introduction or reinforcement of basic mathematics concepts.

D.P.S. stock number is 02-0400.13. Its cost is $2.12.

Criterion - Referenced Tests:

These brief tests are available for each grade level to enable the teacher to pretest student mathematic skills in the fall and post-test them in the spring, thus assessing student progress for the school year.

Pretests

Grade	Stock Number	Cost
2	02.0405.13	.0859
3	02.0405.14	.0857
4	02.0405.15	.0585
5	02.0405.16	.0914
6	02.0405.17	.0654

Answer Key For Pretests

Grade	Stock Number	Cost
2	02.0405.18	.2056
3	02.0405.19	.1973
4	02.0405.20	.1973
5	02.0405.21	.2379
6	02.0405.22	.2238

Post-Tests

Grade	Stock Number	Cost
1	02.0405.01	.0527
2	02.0405.03	.0699
3	02.0405.05	.0719
4	02.0405.07	.0507
5	02.0405.09	.0842
6	02.0405.11	.0588

Answer Key For Post-Tests

Grade	Stock Number	Cost
1	02.0405.02	.0831
2	02.0405.04	.0831
3	02.0405.06	.0831
4	02.0405.08	.0831
5	02.0405.10	.0860
6	02.0405.12	.0860

Primary Arithmetic Materials:

A set of 160 pads, 30 pages each, for use as supplemental drill sheets to accompany the basic textbook. Each pad is a separate drill exercise dealing with basic facts (addition or subtraction), place value, telling time, money, multi-digit computations, etc.

Ordering information is as follows:

Primary Arithmetic Materials, Grade One, Pupil Materials

Stock No. 02.0402.06 $15.56

Primary Arithmetic Materials, Grade One, Teacher's Edition

Stock No. 02.0402.07 $ 6.55

Primary Arithmetic Materials, Grade Two, Pupil Materials

Stock No. 02.0402.08 $15.67

Primary Arithmetic Materials, Grade Two, Teacher's Edition

Stock No. 02.0402.09 $ 4.90

Stretch - Primary:

A collection of activities for mathematically gifted pupils, grades 1-3. The pages are packaged and designed to be placed in a loose-leaf notebook for removal and use as masters. The activities are divided by grade level and skills taught.

The materials are intended for independent student use with a minimal amount of teacher instruction. Activities are designed as a beginning idea leading to further creative thinking.

Stock No. 02.0400.31 Cost - $ 7.73

Stretch - Intermediate:

Contains 104 reproducible pages of math activities for gifted and talented pupils. It presents a wide variety of activities that correspond to skills taught in the intermediate grades. Each activity is independent of the others and varies in difficulty. Activities are designed to be done independently by the student with a minimum of teacher assistance. Stretch activities may be used as models to develop other materials.

Denver Public Schools, 1978 Stock No. 02.040032 Cost $ 4.8617
(Pages are punched for binder)

Supplemental Arithmetic Drill Books:

Available for grades 3, 4, 5, and 6. Contain computational drill materials for whole and fractional numbers. Could be used with those who need extra practice in certain areas or with children working below grade level. An excellent publication to use for homework assignments.

---Pupil Book---

Grade	Stock Number	Cost
3	02-0400.01	$.43
4	02-0400.02	.39
5	02-0400.03	.43
6	02-0400.04	.43

---Answer Key---

Grade	Stock Number	Cost
3	02-0400.05	$.88
4	02-0400.06	.92
5	02-0400.07	.88
6	02-0400.08	.88

B. The following materials were obtained through special purchase and were placed in each building. Answers to questions about these materials may be obtained by calling the office of Curriculum Development.

1. Individualized Computational Skills Kits (ICSP):

   A collection of worksheets designed for remedial use and not as a basal program. Each kit contains a testing program and correlated pads of worksheets broken down into each difficulty involved in the computation skills. Pads may be reordered from the publisher.

2. Metric Measuring Materials:

   A set of materials and equipment to assist teaching of metric measurement. These materials include a scale, a tape measure, rulers, metersticks, capacity containers, a thermometer and filmstrips.